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HOW BEARINGS ARE BABBITTED

Methods Used for Mixing, Pouring, Heating and Peening

While the babbitting of a bearing may not be an essential requisite in the engineering profession, its knowledge will greatly assist the engineer, who, beside knowing how to operate his engine, should also understand the repairing of its many parts without calling for the assistance of a mechanic.

Babbitt or anti-friction metal is composed of tin, antimony and copper mixed in various proportions, and may be purchased, or, if it is desired, it may be easily made. A good mixture, suitable for general use when the duty imposed is light, is composed of fifty parts tin, five parts antimony and one part copper. A harder composition, sometimes termed white metal, is composed of 96 parts tin, 4 parts copper and 8 parts antimony. This mixture is especially suited for journal boxes or bearings, and is mixed as follows: First melt 12 parts of copper and then add 36 parts of tin; 24 parts of antimony are put in and then 36 parts of tin, the temperature being lowered as soon as the copper is melted, in order not to oxidize the tin and anitmony; the surface of the bath being protected from contact with the air. The alloy thus made is subsequently remelted in the proportion of 50 parts of alloy to 100 parts of tin. For brass bearings or boxes, a mixture of 64 parts copper, 8 parts tin and 1 part zinc will be found to answer very well; but for bearings not requiring so hard a metal the quantity of zinc is increased and that of the tin diminished.

The principal advantage of babbitted bearings is the ease with which it may be renewed, and the fact that the metal will soon bed itself to the journal. This is of great advantage in the case of solid bearings in fast running machines and in places where it would be awkward or difficult to take brasses or bushes out to fit them, or align them to the shaft, which in many cases would also require to be taken out to remove the brasses. On the other hand, it has the disadvantage that should any particles of grit find their way into babbitted bearings they are liable to become bedded into the babbitt metal and cut or grind away the journal.

Bearings that are to be babbitted are usually cast with a receptacle for the babbitt metal, as shown in Fig. 1, there being a rib at A. B. and C, forming the cavity D, into which the melted metal is poured. These ribs, in new boxes, are sometimes bored out, or for rougher work may be chipped and filed out to fit the shaft and hold it in line. To prevent the ribs A. B and C from bearing and cutting the shaft, a piece of pasteboard is laid on ribs A and B, thus confining the journal bearing to the babbitt. The best method is to pour the bearing and then rivet the babbitt well into the cavity D, which is made wider at the bottom to prevent the babbitt from coming loose, and then bore out the bearing in the usual manner.

Fig. 2 shows a bearing lined with babbitt metal in such a way that the babbitt metal covers nearly the whole of the bearing surface of the bearing, while Fig. 3 shows the method employed for very heavy bearings. In large bearings the babbitt

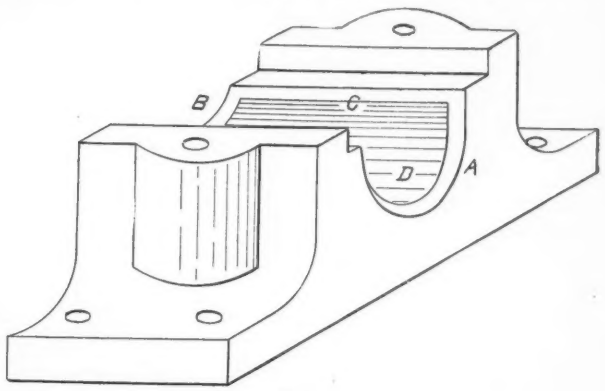


Fig. 1

metal is sometimes fitted in, in separate solid strips, as shown in Fig. 4, each strip being fitted and driven in like a key.

As the babbitt metal in a bearing is apt to close across the bore when cooling after being poured, a mandrel of slightly larger diameter than that of the journal should be used to run the bearing on in place of the working journal or shaft. Some mechanics effect the same purpose by wrapping paper around the journal, but it is wrong to use the journal for the following reasons: To get a good, sound, well-fitting babbitt bearing, the metal should be poured as cool as possible, for if it is heated red-hot it contracts so much in cooling that it does not fit well in the box or frame of the machine. On the other hand, unless the metal is well heated, it is liable to cool and set too soon and thus become unsound. In remedying this the journal or whatever represents it, must be heated and the heating is

very apt to bend it. It is obvious then that instead of the journal or shaft, a temporary iron bar of slightly larger diameter than that of the shaft or journal, should be used. The bearing into which the metal is poured, as well as the mandrel or bar of iron should be heated to about 200° to 300° Fahr., which will enable the babbitt metal to be poured less hot than would otherwise be permissible, thus reducing the contraction of the babbitt in the bearing to a minimum. A little powdered rosin sprinkled in the box will help the babbitt to flow easily, and smoking or chalking the mandrel is also said to make the metal run freer and gives a smoother face. As soon as the babbitt has well set the temporary journal or mandrel should be revolved to free it.

To prevent the metal from running out of the bearing, its ends are closed by means of either clay, putty or red lead closely packed against the bearing ends and the mandrel. In pouring the melted metal it is best to pour it on the top of the mandrel and let it run down its sides into the cavity of the bearing; brass mandrels are said to be better than iron to pour metal around. In pouring the metal on top of the mandrel it heats the mandrel equally and prevents it bending from unequal expansion, as it would do if it met the heated metal on its lower half only. It may be easily seen that if the mandrel bends, the bore of the bearing will not be cast in line; hence the shaft will bear at the end only and will require to wear the babbitt down to a bearing. Great care should be taken to

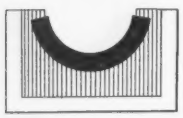


Fig. 2

Fig. 3

Fig. 4

see that bearings are level and in alignment, otherwise unequal pressures and reduction of bearing surfaces will cause trouble, as the leverage or screwing force of a shaft out of alignment is enormous in its destructive force on a bearing. To start a bearing right and see that it is true, and that the shaft is in contact at every point, and watch it carefully until it becomes well seated, will well repay the time and trouble given it.

Babbitting is sometimes employed to refit parts that have worn loose, or to bush the bore of a casting. Suppose, for example, that in cases of emergency a pulley of a certain diameter is required and the only one at hand has too large a bore. Then a mandrel or arbor is used, having the same diameter as the shaft on which the pulley is to be used, and drive on this mandrel two thin washers. These washers are then turned to fit the bore of the pulley, and a recess cut in each to enable the metal to be poured through. The mandrel and washers are then put in the pulley, the washers serving to hold the mandrel true, and the bore filled in with babbitt metal. The pulley set screw should be left in place and set to just touch the mandrel, so as to cast the thread in the babbitt bushing, and thus save drilling and tapping.

When pouring a bearing have all arrangements complete so that when the metal is ready to pour there will be no awkward delay that will cause the metal to remain over the fire until it becomes too hot, as overheating babbitt metal adds to its brittleness and increases its contraction. Babbitt metal is not more sensitive to heat than other similar alloys; but any alloy, when highly heated, oxidizes more readily and the various metals of which it is composed separate more readily. Therefore the heat should be checked as soon as the metal begins to show a yellowish tinge, and not be allowed to heat until the oxide turns red. The pot and ladles should be clean, as a very small percentage of certain impurities or metals will often sensibly effect an alloy and impair its value, and the faces of bearings and mandrels should also be clean and free from grease or dampness. A hot ladle can be cleaned by brushing it with rosin, and if powdered rosin is sprinkled on a ladle full of metal it quickly reduces the scum or oxide and allows only the pure free metal to flow into the bearing that is being poured. Great care should be used to prevent this oxide from entering the box, as metallic oxides are injurious to babbit metal and it is advisable not to use a pot or ladle in which zinc or zinc alloys have been used. When pouring, hold the ladle as closely to the work as possible to avoid air bubbles and cooling and see that there is sufficient vent for the escape of air and gases. In large, close castings, pouring metal through a funnel will take up shrinkage if some metal is left in funnel above surface of casting. If, after pouring a bearing, the babbitt metal flakes off or contains hard and soft spots, it is because it has been left in a highly fluid state too long without proper stirring. It is important to stir frequently, bringing the metal up from the bottom, to prevent separation of the different ingredients, which have different specific gravities, thereby preserving a homogeneous alloy and preventing a segregation of the tin, copper and antimony. The frequent melting of any metal or alloy seems to affect its strength, but this can be overcome to a considerable degree by adding new metal to each melt. As the peening of babbitt metal does not improve its anti-frictional qualities and necessitates boring or machining, it is only recommended where necessary to take up shrinkage and tighten metal in place. However, when necessary to peen, it is best to commence peening up and down a center line, parallel with axis, extending blows right and left of this line until tightened in place.

After bearings have been babbitted they should be kept snug and not keyed down too tight, particularly at the start, until all the rough places and inequalities of the bearing have worn down to a smooth surface, and the journal rests upon it at every point. This is most important to insure successful results with a babbitted bearing.

Steel Trust to Use Gas Engines.

As a result of a number of tests which have been made at the Edgar Thomson plant of the United States Steel Corporation, it has been decided to equip all the plants of the Steel Trust with gas engines. At Gary, Ind., where a new plant is being built, twenty gas engines will be installed to furnish power and to "blow" the furnaces. The gas used will come from the furnaces, and after being thoroughly scrubbed will be used to run the electric generators and blowing engines. It is said that the cost of this engine equipment will amount to $3,000,000. Fifty-two steam engines will also be replaced at the Edgar Thomson plant with gas engines, so that when all the other plants are considered, the expenditure involved in changing the kind of prime-mover will be enormous.

A TALK WITH A CHIEF ENGINEER

Practical Pointers in Reference to the Turbine, Indicating Corliss Engines, Surface Condensers and Books

By William Kavanagh.

Talk No. 3.

Having had some difficulty in obtaining correct indicator cards from his Corliss engine since his No. 2 talk with the chief engineer, the writer decided to make another call on the chief and learn from him where the trouble might be found. The writer was aware that the chief was thoroughly conversant with the Corliss and other types of engines, hence his desire to have a talk on this and other subjects.

When the writer entered the engine-room which the chief so ably conducts, he was received very cordially by him. Setting a chair over to one side of the desk, he asked his visitor to be seated. The chief was very communicative and began by springing a surprise on the writer by asking him if he noticed anything strange about the engine room. The writer answered in the negative, to which the chief replied: "Well, since you were here last, I installed a small turbine, direct-connected to a small generator, to be used principally at night. If you look back of the Corliss engine you can see where we put it, and, I can tell you, it runs almost noiselessly. I have had no time to learn of its economy, but I think it will prove just as economical as the small reciprocating engine which it has displaced. You see it is a very handy engine to erect. It doesn't require much space, and almost any kind of a foundation will do to hold it in position."

As the writer had not had an opportunity to become familiar with this type of engine, he asked the chief to explain the principle upon which the steam was used to drive it. The chief replied by drawing a sketch similar to that shown in Fig. 1, and volunteered the following information: "You know that you have learned in physics that action and reaction are equal and opposite in direction, and you also know that the tendency of pressure is always in the direction of a straight line, hence the steam in acting on the stationary blades, B, B, reacts on the movable blades M, M, and motion results. Notice how I have drawn the darts D, D. The steam entering the ports at K will try to pass in a straight line through the various openings, as indicated by the darts K, K, with the result that it will take the direction D, D, the resultant being a pushing of the movable wheels M, M, which are keyed to the shaft, and motion is obtained. You see there are no reciprocating parts to look after, hence it is very simple and reliable. If another stage of stationary and movable blades be connected to the exhaust chamber E, a further expansion of the steam can be obtained, and in this way nearly all the effective power can be realized from the steam." The writer admitted that this was a very simple form of engine, but could not readily see why leakage did not occur. The chief said: "There was a slight leakage, but not enough to cause apprehension of uneconomical operation. You know," continued the chief, "that nearly all reciprocating engines leak more or less, and if you spread out the piston packing rings so as to make them perfectly steam-tight, cutting of the cylinder is likely to occur."

After this explanation of how the steam was made to do work by pushing around movable wheels having blades or buckets attached to their periphery, the writer asked the chief to give his opinion on some indicator cards which had recently been taken from the writer's Corliss engine, and if, in his opinion, the Corliss valves were in need of setting. The chief, after viewing the cards, refused to give his opinion as to whether the valves should be set or not, and he based his refusal in the following language:

"Of all the engines which are indicated, the Corliss engine is one of the most deceptive. Unless all rods are properly adjusted, the toe-clips and knock-off cams are in good condition, and the dash-pots operate positively and in proper time, you will imagine on taking and reading a card from a Corliss engine in which any of these things are defective,

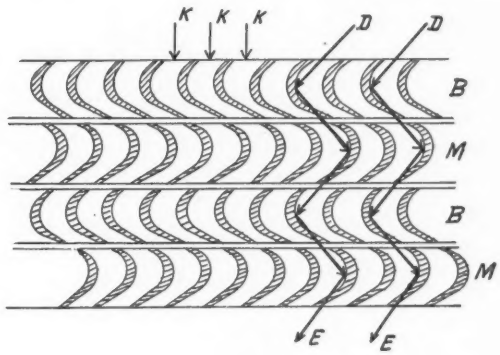


Fig. 1

that the valves are in need of setting. Now let me tell you what to do before going to the trouble of resetting your Corliss valves. Of course you know the point at which the governor rotates when the engine is carrying its average load. Well, when you get a chance, stop your engine and block up the governor to this point and let the crank pin be in any position. Now unhook the eccentric reach-rod from the wrist plate and engage the lifting toes with the valves; then by moving the wrist plate back and forth slowly you can easily detect which knock-off cam unhooks its valve first. Another way is to measure the wrist-plate travels from both sides of the centre-line, which you will find marked on the stand that supports the wrist-plate. You can use a compass or dividers in taking these measurements, and by lengthening or shortening the cam rods from the governor you can make the distance the wrist-plate travels on both sides of this line equal when the valve drops for cut-off. The dash-pots should act positively and quickly every time a valve is unhooked; otherwise there will be no use trying to take indicator cards which are reliable.

"Some engineers make the very common mistake in try-

ing to obtain equal steam lines, or, in other words, equal points of cut-off on their cards, and in trying to accomplish this impossibility are always tinkering at their valve mechanism or moving their eccentric. Of course you know the reason why equal points of cut-off cannot be obtained owing to the crank-pin being behind the position it should occupy on its out-board or crank-stroke, and ahead of the position it should occupy on its in-board or head-stroke. This is why we cannot get equal steam lines, and therefore equal points of cut-off. However, it is reasonable to expect that if the valves and dash-pots operate correctly by hand, they will operate practically correct when the engine is in operation.

"Sometimes the valves stick, owing probably to some defect in their manufacture or from poor lubrication, or it may be that the stuffing boxes are screwed up too tight, thus preventing the dash-pots from closing the valve quickly.

"A first-class quality of lubricating oil should be used on the valves and in the cylinder, otherwise the valves may become gummed and operate sluggishly. You will often hear it said that a cheap oil is just as good as an expensive lubricant. Now don't believe such nonsense. A first-class oil enables the valves to close with a snap, and if the valves are steam-tight this means economy in fuel and a realization of nearly all the practical benefits to be derived from the expanding steam. Let me also say that when your steam valves and dash-pots are operating satisfactorily, each dash-pot should lift the same distance and then each steam port will open an equal amount. You can measure the distance the dash-pots lift; and the height that each plunger lifts should be as near as it is practical to have them do so.

"Did Kingsley, the chief down at the mill, tell you the changes they are making down at their power house? I believe they are going to dispense with the old-time jet condensers and install in their place two modern surface condensers, which will be a great improvement to the plant. You see, the surface condensers supply clean condensed water for the boilers and utilizes all the exhaust steam in doing this. The surface condenser has many advantages over the jet condenser. In the first place, it can be operated independently of the engine; in the second place there is no danger of flooding the engine or engines, and in the third place, if no leaks occur, only the initial supply of water is required for the boilers, hence all the scale-making properties contained in this initial supply water will be all that is deposited in the boilers; therefore the boilers cannot receive a regular supply of scale that is contained in each fresh supply of water to the boilers. Let me make you a sketch of the surface condenser. You may need it some day when you take charge of a condensing plant," said the chief as he drew a sketch similar to Fig. 2. In explaining its action he said: "The cool condensing water is forced through the tubes at A and B and out through C. The exhaust steam enters at E and strikes the baffle plate P. The exhaust steam circulating around the outside of the tubes comes in contact with their cool surfaces and is condensed, falls to the bottom of the condenser and flows out through F, where it is taken by an air-pump and discharged into the hot-well. The feed-pump takes the water from the hot-well and discharges it into the boiler, either direct or through a feed-water heater. The air-pump not only keeps the condenser clear of condensation, but it also forms a vacuum in the condenser which materially decreases the back pressure against which the engine would otherwise have to operate.

"If the feed-water taken from the hot-well is forced through a feed-water heater, the vacuum formed in the condenser can be maintained at a high standard, but if no heater is used, then the vacuum should not be carried beyond a certain limit, because what we gain in vacuum is lost in the temperature of the feed-water. Of course, there are other modifications of the surface condenser, but the sketch I have given involves the principle upon which all surface condensers operate."

The writer then asked the chief his opinion with respect to the best books on steam and electrical engineering. The chief gave his opinion in this manner: "You know, Kingsley, the chief down at the mill, bought a set of engineering books, and let me tell you, that unless you have a sound college education, there is no use trying to read them. Those books are full of algebraic formulae, and it is a difficult thing for engineers, who have to keep things moving, to learn those formulae. For my part I prefer a good mechanical paper, because it is generally edited by practical men, and if you cannot find what you want in the paper, all you need to do is to write to the editor and he will answer you in a simple, practical way that you can easily understand.

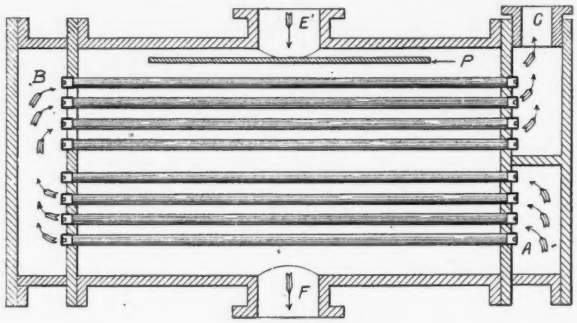


Fig. 2

"Let me given you an illustration about the books Kingsbought. Well, down at the mill the directors decided to install a large storage battery and an ice machine. As Kingsley had never had any experience with storage batteries and ice machines, he hunted up his books for information on the subject and found a chapter relating to each. Well, Kingsley thought he was all right and started in to study those chapters. One evening Kingsley dropped in to see me, and he was hopping mad. 'Look at here, chief,' says Kingsley. 'I will let you have these books at half price.' But I told Kingsley to keep his books and I would help him as best I could. I also told him that the next time he visits me I will give him all the information on storage batteries and ice machines he will ever need."

The writer inquired of the chief about the time Kingsley would call, so that he could hear the conversation, and the chief answer he would telephone the writer. The writer then thanked the chief for his kindness and, promising to come over whenever the chief telephoned him, he started to his engine room to study over the subjects which the chief talked about.

MODERN WATER SOFTENING APPARATUS

Continuous Methods Used for Preventing Scale

It is generally conceded that there is nothing of greater importance in power plant economy than the consideration of the feed water supplied to the boiler. There has been

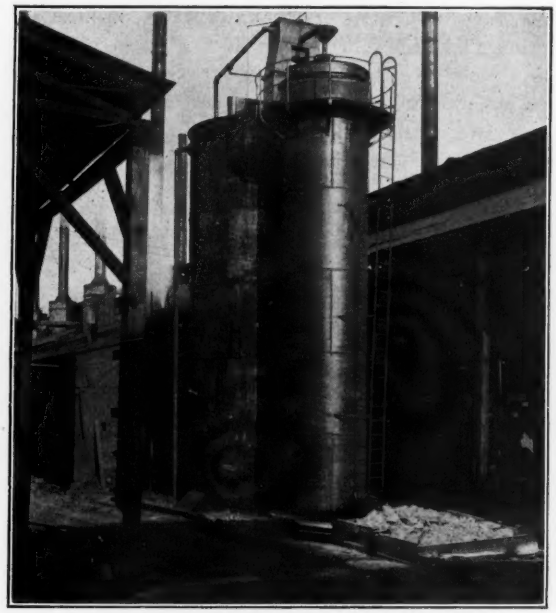


Fig.1

much attention paid to the use of stokers, heaters and fuel economizers, as well as other auxiliary apparatus, and there has been a great improvement in the construction of steam engines and turbines, and the utilization of condensers and superheaters, but only until recently has there been more

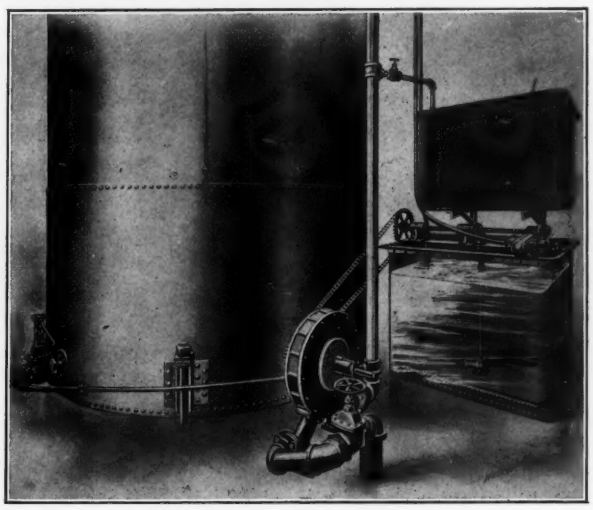


Fig. 3

consideration than heretofore paid in the study of boiler water and softening apparatus.

One of the most interesting of American systems of water purification is that utilizing a small lime saturating tank and a large decanting tank for the precipitation of the scale-forming constituents after being acted upon by the lime solution and reagents.

The Eureka water softening apparatus shown in the accompanying illustration, Fig. 1, is of the continuous and automatic type, with a daily capacity of 257,000 gallons for 24 hours. This installation was made at Knoxville, Tenn., for the Knoxville Iron Company. The method of operation of the Eureka water softening apparatus is such that the water to be treated enters the top tank and is divided under proper automatic control for delivery, a small portion flowing to the saturator and the greater portion to the decanting tank. On its way to the decanting tank the water passes over a wheel whose rotation actuates the stirrer arms in the saturator. The latter with its stirring apparatus supplies a continuous supply of saturated lime solution, which is fed with other reagents in proper proportion, under automatic con-

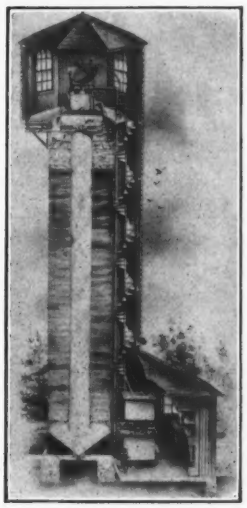


Fig. 2

trol, from a small tank into the central tank of the decanter. The reaction takes place here, the water passing downward and returning upward in the main body of the large tank, passing spirally among slanting settling plates.

The form scaling matter and other impurities are deposited on these spiral surfaces in flakes which gravitate freely to the conical bottom of the main tank, where they are passed off into the sewer by the occasional opening of the proper valve, while any sediment forming at the bottom of the lime saturator tank may be similarly blown off through another valve. The water as drawn off from this apparatus is thoroughly softened and purified as it continues upward and passes through filtering material into an annular space.

The accompanying illustration, Fig. 2, shows the construction of a unique form of American water softener, in which the crude water supplied at the ground floor operates a small motor without waste, rises to the measuring and

mixing mechanism at the top of the settling tank, and there receives a definite percentage of reagent which is automatically added. It is then delivered with a whirling motion to the down-take, precipitating and coagulating the scale-form-

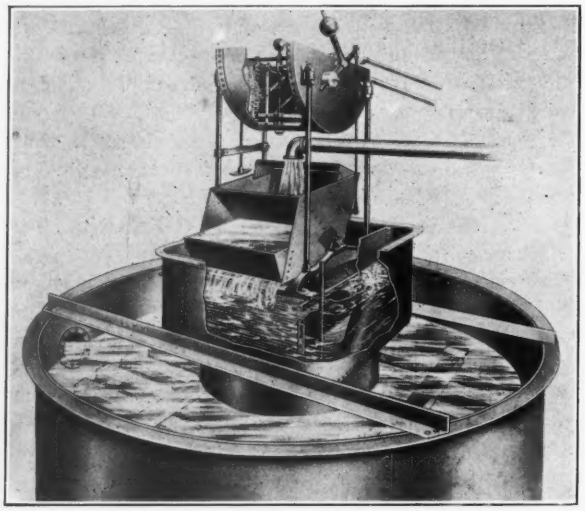


Fig. 4

ing solids, impurities and matter held in suspension. The precipitate which does not settle in the passage down the down-take drops out during the very slow rising in the increased area of the up-take, leaving practically no work to be done by the filter. The storage tank then receives the clear purified water which flows to it by gravity. The

Fig. 5

accompanying illustration, Fig. 3, shows the mixing tanks and water motor, this mechanism for mixing and handling the softening solution being arranged on the ground floor. Fresh-burned lime is slaked in sufficient amount for twelve hours' operation in the upper tank, and, after slaking, the valve is opened and the lime milk drops into the lower tank through a screen that removes the foreign matter. Soda ash in the proper amount is then added, and the whole solution thoroughly stirred and kept in constant motion. The pump is operated by the shafting which operates the agitator. This pump draws the solution through a fine strainer and raises it to the chemical tank at the top of the tower. The accompanying illustration, Fig. 4, shows the tipper and solution reservoir. The crude water flows through a large pipe into a chamber of the oscillating receiver. As this chamber is filled, the centre of gravity moves till equilibrium is lost and the receiver tips, pouring its contents into the tank, and at the same time bringing the other chamber of the receiver beneath the orifice of the supply pipe.

Above the receiver is the semi-circular reservoir tank containing the softening solution, in the bottom of which is a valve through which the solution falls into the oscillating

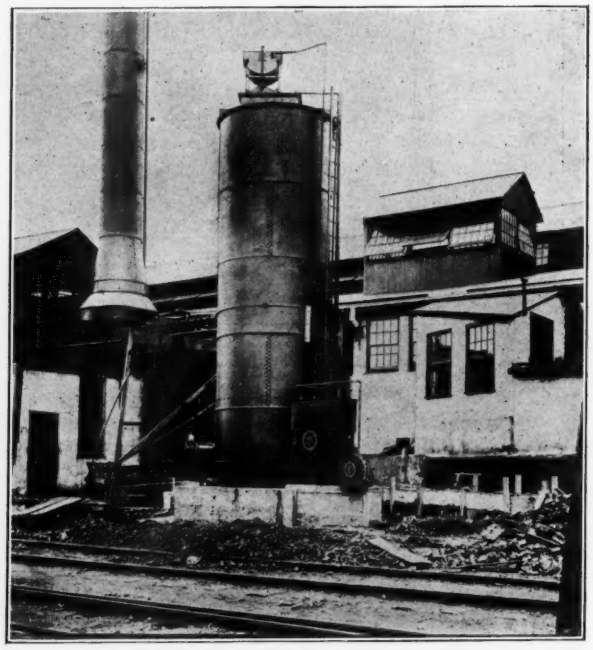


Fig. 6

receiver. This valve is operated at each oscillation of the receiver, delivering a definite, constant amount of solution at each oscillation. The lift of the valve is quickly and easily regulated for any required amount of softening solution. The oscillator is always operated by the same amount of water, and the valve, with the constant head of solution in tank, always feeds exactly the required amount of solution, whether there is one or ten oscillations a minute. A paddle is fixed to the underside of the oscillating receiver to prevent too violent movement of the tank and more thoroughly mixes the water with the softening solution.

The accompanying illustration, Fig. 5, shows an American water softener of 15,000 gallons per hour capacity at Richmond, Ind., of the Pennsylvania lines west of Pittsburg, while Fig. 6 shows an equipment of 2,400 gallons per hour of treated water installed at Phoenixville, Pa., at the

works of the Heine Safety Boiler Company.

The cost of operating an American water-softener of this type is slight, the chemicals used being mainly lime, which cost about ¼ cent per pound and soda ash costing 1 cent per pound. The quantities used makes the total cost range from ½ to 3 cents per 1,000 gallons of water treated, depending on the quality of water. It is stated that the plant automatically starts and stops according to the amount of treated water required, and there is no hoisting of material necessary.

Best Form of Power for Stations of 500 K. W. or Less

Choice of 2-Wire 220-Volt, 3-Wire 110-Volt, D. C. and Single-Phase or Polyphase Alternating Current

In a paper recently presented at the Toledo Convention of the Ohio Electric Light Association, Prof. F. C. Caldwell took up the subject of the best form of "Power for stations of 500 kilowatts or less," in which he stated that the systems available were direct current, two-wire, 220-volt and three-wire, 110-volt; alternating current, single-phase or polyphase.

The choice between these will depend, first, on the character of the load to be supplied; second, upon the size of the plant; and third, upon the conditions under which it will be operated. A few years ago the two-wire, 220-volt, direct-current system seemed likely to take an important position for the smaller central station supply. Two factors, however, have recently been introduced into the problem, both of which are unfavorable to its growth. The first of these is the development of metallic filament incandescent lamps. The low resistivity of metals, as compared with carbons, makes the extension of these to voltages as high as 220 seem improbable, while the great saving in energy, resulting from their use, dare not be overlooked. The other factor is the placing on the market of successful three-wire generators at a cost not greatly in excess of the standard type.

The 220-volt system has never been much used in this country outside of the smallest plants, though its simplicity and comparative economy in distribution were strong arguments in its favor. It will doubtless continue to be employed in cases where transmission for power purposes is the main business; but where lighting is an important element, it is probable that it has passed its period of greatest usefulnes. The problem may, therefore, be narrowed down to a question of three-wire direct current versus alternating current, single-phase or polyphase.

As between the direct and alternating current, this question of distribution of load is the most important factor. Wherever more than one town is to be supplied with energy from the same plant, or where the character of the farming population is such as to make the sale of energy for lamps and motors among them a matter of importance, the decision must be in favor of alternating current. On the other hand, where the conditions seem to set definite and comparatively narrow limits to the area over which the plant will supply energy, the greater simplicity, higher economy in distribution and superior regulation usually obtained from direct current plants, may determine in favor of this form of supply. The amount and character of the motor load must be given careful consideration. If this is large in the immediate vicinity of the power plant and especially if variable speed is important, the direct current will have the preference. If, on the other hand, the demand is more widely scattered, or is of such a nature that the simplicity and brushless character of the induction motor recommend themselves, the decision may be favorable to alternating current.

The use of the storage battery in connection with the direct-current system gives it an advantage. In some cases, for instance, it may be possible to supply direct current for 24 hours with the use of only one 10 or 12-hour shift, at the same time obtaining the great advantages in the matter of regulation and storage against an emergency shut-down which are provided by the battery. Such a use of the battery, however, would only be possible in cases where the motor load is negligible, a condition which is in itself unfortunate. In general also the small plant is unable to supply the same quality of expert attention for the battery as is possible in larger stations, and this would often make its use questionable.

In the case of very small stations, such as are now being installed to a considerable extent in the villages of the country, the use of an alternating-current system with a frequency of 25 cycles should receive careful consideration. This would often be advantageous on account of the possibility, actual or prospective, of joining up such a plant with the 25-cycle distribution system of some interurban electric railway. Ample experience has demonstrated the satisfactory operation of incandescent lamps with 25-cycle current, and in almost every case it would be more economical to purchase energy from railway systems during a considerable part of the 24 hours rather than to keep the generating plant operating continuously. In many cases the whole output of the station could be most advantageously obtained in this manner. This suggests the supplying of energy from one plant to a number of small towns throughout a given district, a field which deserves more energetic cultivation than it has yet received.

The question of the use of single or polyphase alternating current is also an interesting one. Single-phase motors are obtainable in small sizes running up to about 30 horsepower, so that where the supply of power in large units is not to be anticipated, as, for instance, in the case of a strictly farming community, much is to be said in favor of the greater simplicity of the single-phase. Especially is this true in the case of the smaller plants where it is not practicable to employ a superintendent who has had much training or experience. In the case, however, of the larger plants within the range under consideration, especially if connection with an electric railway supply circuit is considered, the polyphase system should probably be used. With a little more care in distribution, just as good results can be

obtained as with the single-phase, and the possibility of the use of larger motors is always present.

With reference to prime movers, Prof. Caldwell made the following classifications: I. Water power; II. gas power—natural gas, producer gas; III. steam power—reciprocating engines, turbines. With regard to water power, nothing need be said, further than to predict that before many years energy will be developed in Ohio by water power at a greater rate than is now done. It is a very interesting problem, but, of course, peculiar to special localities only.

Where natural gas is available there is hardly room for any further discussion of this subject, so far is the gas engine thus operated superior to all other forms of heat engines. With a thermal efficiency approximately double that of reciprocating steam engines, with the entire absence of loss when the engine is not running and with the great rapidity with which it can be brought into operation, no form of steam engine is to be compared with it for small plants. The complication and liability to accident and shut-down which have been in the past attributed, with more or less justice, to the gas engine, have of late been rapidly losing weight by virtue of improvements in design and greater familiarity on the part of engineers. In the case of small plants for lighting or power purposes, the defect of the gas engine in not having a considerable overload capacity is not so serious as in other lines, although it must be taken into account in the design of the plant.

In the absence of either water or natural gas, the producer and gas engine plant is in free competition with the various forms of steam engine, with a strong indication that the odds are coming to be more and more favorable to the former. Here success depends entirely upon the producer, which seems satisfactory in the case of the harder coals. In Ohio, however, the producer must demonstrate its ability to handle the bituminous coals of the State before it can be generally accepted as a substitute for the steam boiler. Its friends already claim the victory and when account is taken of the relative time that has been spent in the development of the producer and the boiler, those who have been devoting themselves to the former certainly deserve congratulation. With a producr working successfully with soft coal, the steam engine will, indeed, have to look to its laurels, for the possibility of getting nearly twice as much energy from a ton of coal, together with the small stand-by losses and the quick service, give the gas engine enormous advantages against which the somewhat lower first cost and the long-standing reputation of the steam plant cannot long prevail.

Steam is, however, still with us and doubtless will be for some time to come. Thus far the great development which the turbine has induced in the case of the larger stations has not been much felt by the smaller. Although at present turbines in a variety of smaller sizes are available, their use does not show as great an advantage over the reciprocating engine as in the larger sizes; generally speaking, also, in the case of the small station, economy of space is not so vital a matter as with the large city plant. On the other hand, the simplicity of the turbine should be a matter of even greater consequence, so that the question of relative first cost would probably be a determining factor in most cases. Of course, whenever condensing water is available in ample quantity, anything but the very smallest plant should be operated with compound condensing engines. The availability of condensing water would also be important in determining the use of turbines.

The question concerning the use of artificial means for the cooling of condensing water is a financial one, and depends largely upon the price of coal, the cheapness of which in Ohio would seldom permit of the use of this system. Another factor which should always receive consideration and which may at times determine the character of the steam plant, is the sale of exhaust steam for heating purposes. The jacket cooling water in a gas engine plant may be similarly used.

In the case of small lighting and power plants their combination with some other form of industrial activity should be given consideration. In many cases, a power plant may be made to pay if, during the daytime, the energy of the plant can be consumed in the operation of some productive industry. This works out especially well where the industry is of such a character that a part at least of its machinery can be closed down an hour or two earlier during the winter months without seriously interfering with its success. A combined electric and pumping plant is a similar case. This is an especially desirable arrangement, if water storage is available, so that the pumps can be shut down during the period of peak load. In this connection the electrically-driven centrifugal pump which has recently come before the public ought to prove useful.

New Method of Pumping Oil.

An interesting method of pumping oil is about to be employed by the Southern Pacific Company, in California. The pipe line will be 256 miles long from the oil properties in Kern county, in the southern part of California, to tidewater in San Francisco.

Throughout the length of 256 miles of pipe there will be twenty-three pumping stations, the equipment of each station being in duplicate, so that in event of a breakage of any part of the machinery of one pump, the other may immediately be put into service.

A new and interesting feature of the line is the character of the pipe used, its "rifled" construction being a somewhat radical departure from that of lines now in use for conveying oil. Spiral indentations accomplished in the rolling of the pipe constitute the rifling.

An exhaustive series of experiments has demonstrated that after a small per cent. of water has been added to the oil, and the necessary pressure applied, that the whole will develop a whirling motion, and that the water being the heavier, will seek the outside of the pipe, thereby enveloping the oil in a thin film or shell of water; this shell or film of water acting as a lubricant between the oil and the pipe, and thereby greatly reducing the friction and allowing the core of oil to glide through the pipe readily.

With the size of the pipe, which is 8 inches, and the high pressure carried, and improved facilities in every way, a rapid transmission of the oil has been shown to be possible, and it is estimated that at least 23,000 barrels of fuel oil can be delivered every twenty-four hours.

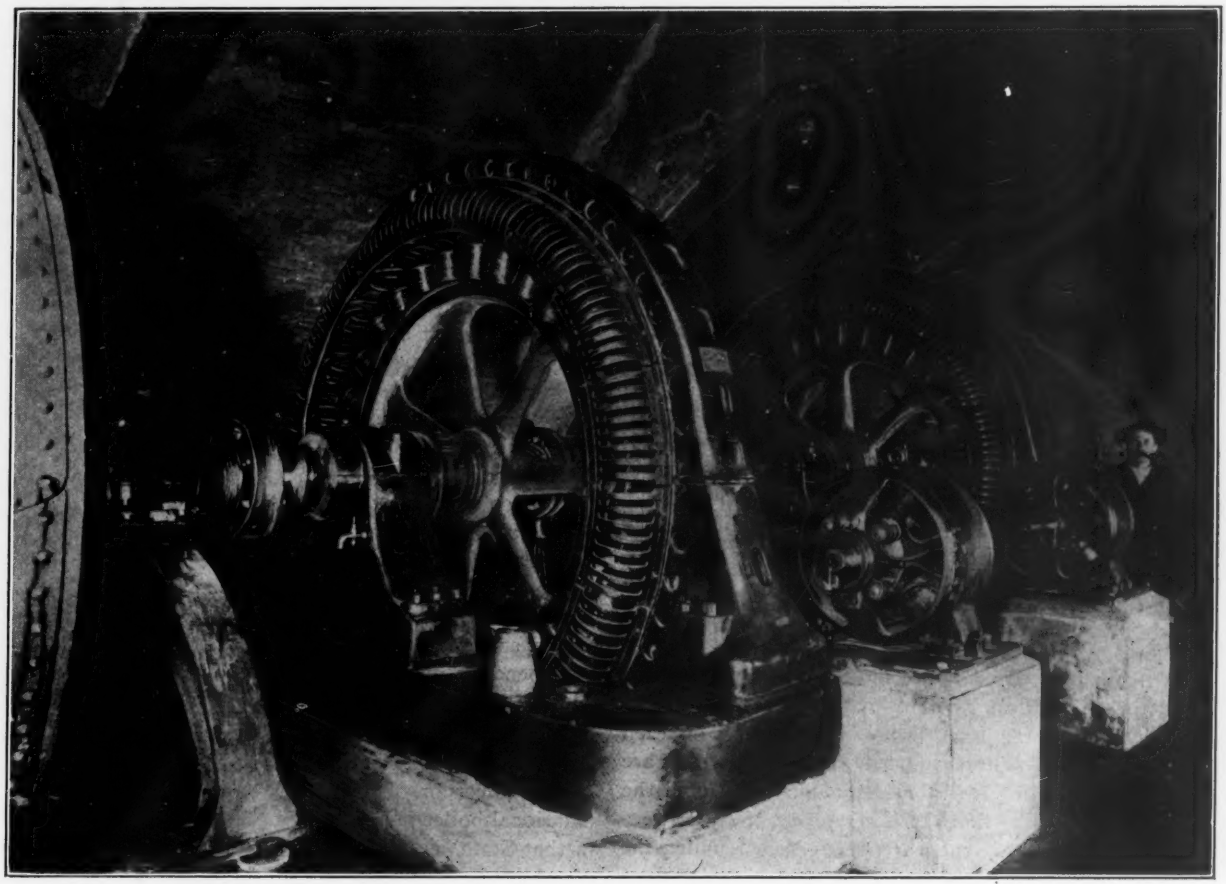
POWER HOUSE BUILT UNDER WATER

Plant of the Patapsco Electric and Manufacturing Company, near Ellicott City, Md.

There are many peculiar locations of power houses which are the result of the humor of the designer, but one of the most peculiar is that of the Patapsco Electric and Manufacturing Company, located at Ilchester, Md., near Ellicott City, where the power house is placed inside the dam, the water flowing over it. The plant is situated on the Patapsco River, about one and one-half miles below another plant owned by the same company, and about three miles from Ellicott City and five miles from the western limits of Baltimore.

there follows down the concrete deck until it reaches the bottom. If it were not for this water it would not be apparent to a person standing in the power house that it was built under water.

The dam has a length of 220 feet and 40 feet 9 inches wide at its base. Its height from the normal tail waters to the spillway is 26 feet 6 inches. At each end the buttresses and deck of the dam rise 10 feet above the spillway, so as to allow for floods. The spillway is 168 feet long and arranged with anchor bolts, so that in case it



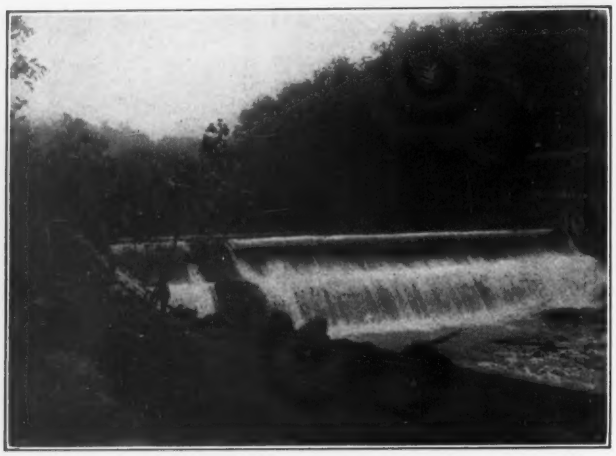
Power Plant of the Patapsco Elec & Mfg. Co., which is enclosed by Concrete Steel Gravity Dam.

That part of the dam which is used for housing the plant is fitted with a false ceiling hung five feet from the inside, so as to protect the apparatus from any water that might seep through the bottom of the dam. The ceiling slopes until it reaches the vertical sides forming the power house. The side next to the tail-water is fitted with windows which furnish the light to the plant, and plenty of light enters by this means even when the water is flowing over the dam two feet deep. That part of the dam not protected by the false ceiling is arranged so that the water which leaks through is gathered on the inside of the deck, and what does collect should be desirable, planks can be bolted to it sufficient to add two feet. The dam is built of reinforced concrete and the "deck" is supported by 19 buttresses 18 inches thick, which are spaced 12 feet on centres. The deck of the dam is 18 inches thick at the bottom and tapers to 10 inches at the top. The part of the dam used for the power house is 108 feet long, 14 feet high and 27 feet wide, except at the buttresses where it is 18 feet.

The power equipment consists of two 32-inch horizontal turbine wheels running at 240 revolutions per minute, each being connected to a 300-kilowatt, 11,000-volt, 3-phase, 60-

cycle Allis-Chalmers alternating-current generator. As the transmission lines cover a large territory, it was decided to use 11,000-volt generators instead of stepping the current up. The turbines are fitted with governors, so arranged that either will control both wheels when the generators are run in multiple. The generators are each excited with a 125-volt generator which is belted to the shaft.

The water for operating the turbines is taken through the deck 5 feet 6 inches below the crest of the spillway, which helps to keep the trash-racks clear of drift-wood, etc. Each trash-rack is 10 feet 6 inches long and the flumes to the turbine 7 feet in diameter. Two waste gates are placed near the bottom of the dam, the water passing under the floor of the power house. The waste water going over the dam is carried on the incline of the spillway to within 16 feet of the tail-water. This causes the water to fall about 10 feet from the side of the dam. The dam backs the water up three-fourths of a mile with an average width of about 500 feet, to the tail-waters of a cotton mill located at Ilchester.



Concrete Steel Gravity Dam of the Patapsco Elec. & Mfg. Co., which encloses Power House

The switchboard located at the end of the power house is 10 feet 8 inches long, and 8 feet 3 inches high, stands 12 feet from the wall, and is enclosed by grill work on each end. It is fitted with three volt-meters, two of which are connected directly with two phases (at bus-bars), and the other through plugs, so that the other phase of either generator can be read. A synchroscope is placed under the volt-meters, all of which are mounted on swinging brackets attached to the end of the board. As the exciters are arranged to be operated in multiple, a regulator is used for controlling the voltage of the generators. Three ammeters have been provided for each generator, so that it can be told at a glance if either phase is overloaded.

Polyphase indicating wattmeters have been provided, one for the street service and the other to indicate the total output; also two polyphase recording wattmeters, one for street service and the other for the commercial circuits. A polyphase curve-drawing wattmeter is further used for recording the total output of the plant. The leads to the generators and commercial and street feeders are fitted with distant-control oil circuit-breakers with disconnecting switches. The breakers for generators have time limit relays, so in case of trouble on the outside feeders they will not be thrown before the others.

The plant will supply current for both power and lighting. At present Ellicott City, Catonsville, Irvington, Carroll, Halethrop, Arbutus, St. Denis, Elkridge, and a part of West Baltimore are being supplied from the other plant, the territory covered being about six by ten miles. There is quite a large day load, as about 250 horse-power in motors is supplied at different points. As soon as this plant is in operation it is intended to extend the lines to West Arlington and Mount Washington, about 14 miles.

Gas From Waste Products of Farms.

A new gas plant at Beatrice, Neb., has apparently solved the fuel problem for the great Central West, which is without native gas coal, but which has millions of tons of straw, corn stalks and corn cobs which are considered waste matter on the farms at the present time.

The idea of utilizing these waste products as fuel was worked over by a Western inventor for three years, and it is claimed that the idea has been practically demonstrated in the new gas plant at Beatrice. Instead of burning high-priced coal and oil, this plant simply uses the waste products of the Western farms, and the gas it furnishes for lighting the streets and dwellings of the town is claimed to possess 10 per cent. more heating power than the best coal gas. It is claimed that while coal gas produces 600 British thermal units, this new gas will produce 660 units of heat in the same time.

Another interesting feature is the several by-products which this vegetable fuel produces and which are claimed to be more valuable than the gas. It is said that one ton of corn cobs or stalks, treated in this plant, will produce 16,000 cubic feet of gas, and that after the gas has been extracted there remains 600 pounds of good coke.

The utilizing of farm waste products as fuel seems to show bright prospects for present and future gas companies, as well as for the people of the West, who now have to depend on the Coal Trust for heat and fuel of every kind.

New Massachusetts Boiler Inspectors.

The Governor of Massachusetts recently appointed five additional boiler inspectors, provided for by the Legislature of that State, as follows: William W. Ramsey, Lawrence; Franklin L. Furbush, North Adams; Wilbert E. Simm, West Somerville; Henry Bushek, Salem; Harry E. Morton, Hyde Park. These men respectively secured the first, fourth, fifth, sixth and seventh highest marks in the civil service examinations. As the duty of these inspectors, among other things, is to examine engineers for licenses, the men passing with the second and third highest marks were not appointed because one did not have an engineer's license, and the other had not had the five years' experience as an engineer, both of which are required by the law.

As a result of a fly-wheel explosion at Kalbach's sawmill, near Pondsville, Md., four men were killed and several employes had narrow escapes from the flying pieces of iron.

USE OF THE HATCHET PLANIMETER

How to Construct an Instrument for Finding the M. E. P. of Indicator Cards

By R. T. Strohm.

After he has secured the diagrams from his engine by the use of the indicator, the next point that demands the attention of the engineer is the calculation of the horse power from the diagrams. This involves the necessity of first finding the mean effective pressure. Now, there are a number of ways of proceeding to determine this important factor. Perhaps the most commonly used method is that of ordinates, in which the diagram is divided into vertical sections of equal width, an ordinate erected at the middle of each section, and the mean or average length of these ordinates found by taking their sum and dividing it by the number of ordinates used. The length of this mean ordinate, in inches, multiplied by the scale of the indicator spring used in taking the diagram will give the mean effective pressure of that particular diagram.

The greater the number of ordinates used, the more accurate is the result; that is, the more nearly does the calculated mean ordinate approach the actual value. The product of the length of the mean ordinate thus found and the length of the diagram will give the area of the diagram. Conversely, if the area of the diagram is divided by the the length of the diagram the quotient must obviously be mean height, or mean ordinate of the diagram.

The planimeter is an instrument whose purpose is to determine the area of an irregular figure. In its more accurate form it consists of two hinged legs, one of which is fixed at one end; the other leg at its free end carries a tracing point, and near the hinged point a recording wheel. By running the tracing point around the outline of a diagram, the area of that diagram may be read at once from the graduations marked on the recording wheel. This form of instrument, however, must be of accurate workmanship, and is therefore usually too expensive to permit it to be a part of every engineer's set of instruments.

It is perhaps not generally known that a cheap and fairly accurate form of planimeter may be made by anyone who possesses the least bit of skill. The inexpensive planimeter referred to is known as the hatchet planimeter, and is illustrated in Fig. 1. It consists of a piece of steel wire having its two ends bent over in the same plane, forming two parallel legs, one somewhat longer than the other. The longer one is tapered and brought to a fine rounded point that may be moved along the line of a diagram without scratching or penetrating the paper. The other end or leg is flattened and ground to a sharp curved edge that much resembles the cutting part of a hatchet. This sharpened edge acts as the recording end of the planimeter.

From the foregoing it is evident that the construction of the hatchet planimeter is a simple matter. A piece of steel wire 15 inches long and 3/16 inch or ¼ inch in diameter will answer the purpose. But it is necessary to observe two points in the construction. The first of these concerns the accuracy of the instrument and relates to the hatchet end. The cutting edge of the hatchet must be exactly in line with the tracing point. If it is not, the instrument will be more or less inaccurate, depending upon how far out of line the hatchet edge is.

It is an easy matter to test the accuracy of alignment of the edge with the tracing point at the end of the longer leg. To do so, draw a straight line on a flat piece of paper. Place the hatchet edge *b* and the tracing point *a* both upon this line. Then, holding the longer leg lightly between the fingers and thumb, move the tracing point *a* carefully along the straight line for a distance of six inches or more. If the hatchet edge is in line with the tracing point, both will be on the drawn line at the end of the motion. If they are not in line, the hatchet end will be found to have moved to one side of the drawn line during the motion of the tracing point. By repeated trial and grinding of the hatchet the instrument may be made to work accurately and follow a straight line for both directions of motion.

Fig. 1

The second point to be considered in construction concerns the convenience of using the instrument, and relates to its length. In a planimeter, the product of the length of the tracing arm and the movement of the recording wheel gives the area of the figure traced. In the hatchet planimeter, the distance from the tracing point *a* to the point where the curved hatchet edge *b* touches the paper is the length of the tracing arm. If this is made some odd length, just whatever it happens to be, it may be that the length of the tracing arm will be something like 11⅝ inches or 9 15/16 inches, or some equally inconvenient length. If the distance from *a* to *b* is made precisely 10 inches, however, there will be a saving of much unnecessary work. For, when it becomes necessary to multiply by the length of the tracing arm, if it is 10 inches, the decimal point may be shifted one place to the right. Whereas, if the length were 11⅝ or 9 15/16 inches, a tedious calculation would be involved. Consequently, a tracing arm 10 inches long will be found more convenient than any other length.

Being assured that the planimeter is accurate, that is, that the point and the hatchet are in line and the distance *ab*, Fig. 1, is exactly 10 inches, the instrument is ready to use. However, in the use of the instrument it is necessary to observe additional precautions.

In the first place, the center of gravity of the diagram should be located as nearly as possible. This may be done with more or less accuracy merely by inspection of the diagram. It would be better, however, to cut out several diagrams of different areas and locate their centers of gravity by balancing them repeatedly on a pin point. Of course, an exact balance will seldom, if ever, be obtained. But successive trials will serve to show, approximately, the point at which the diagram will balance, and this may be taken as its center of gravity. Having determined the centers of gravity of several sizes of diagrams, they may be kept on hand to be used as templets for locating the centers of gravity of cards of equivalent areas.

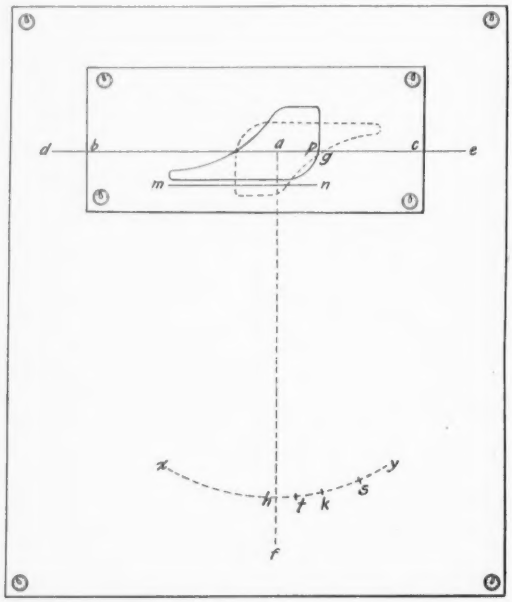


Fig. 2

After locating the approximate center of gravity of the diagram, fasten the card to a drawing-board or other flat surface on which a larger sheet of white paper has previously been placed. This may be done by the use of thumbtacks, as shown in Fig. 2. Suppose that *a* represents the center of gravity of the diagram. Through this point draw a long line *bc* parallel to the atmospheric line *mn* of the diagram and continue the line *bc* until it extends beyond the edges of the card to the points *d* and *e* on the paper sheet.

Next draw another line from the point *a* at right angles to the line *bac*, extending it well toward the bottom of the sheet. This line will then be in the position shown by *af*. Now take the planimeter and set the tracing point exactly on the point *a*, placing the hatchet on the line *af*. The hatchet end will then rest at some point *h*, and this point should be located by pressing hard enough on the short leg of the planimeter to cause the hatchet edge to mark the point.

Now take hold of the longer leg of the instrument, being careful not to grasp it so tightly as to interfere with the free movement of the shorter leg. Then move the tracing point from *a* to *p* on the horizontal line, and then around the diagram in the direction of the hands of a watch until the point *p* is again reached. Then return from *p* to *a* along the same horizontal line. When the tracing point is again brought to rest at *a* after this complete circuit of the diagram, it will be found that the hatchet edge will occupy a different position, say at the point *s*. Mark this point by pressing the hatchet against the paper, as before.

Now loosen the thumb tacks holding the card, and, keeping the tracing point of the planimeter on the point *a*, rotate the card around this point until the diagram has made exactly one-half of a revolution and the line *bc* is again in line with *de*. The diagram will then be upside down, as shown by the dotted outline. Fasten the card in this position by thumb tacks. Then move the tracing point out along the horizontal line from *a* to *q*, and around the inverted diagram in a direction opposite to the motion of the hands of a watch, returning to *q* and then to *a*. The hatchet will then occupy some position such as *k*, which should be marked.

It will be evident that the points *h*, *s* and *k* are each just 10 inches from *a*, since the planimeter is assumed to be of that length. Hence, with *a* as a center and a radius of 10 inches, draw a circular arc *xy*, which will pass through the points *h*, *s* and *k*. Locate the point *t* midway between *h* and *k* and measure the distance from *t* to *s*. The distance *ts* then represents the net movement of the hatchet, which means the net movement of the recording point of the planimeter. To measure this distance with accuracy, a scale graduated to hundreths of an inch should be used. The greater the accuracy of measurement, the more closely will the results approach correctness.

Having determined the length *ts*, in inches, multiply it by the length of the planimeter and the result will be the area of the diagram. The area of the diagram, divided by the length of the diagram, will give the mean ordinate or average height, and this height multiplied by the scale of the spring used will give the mean effective pressure.

To illustrate, suppose that a given diagram is 3½ inches long, and that, after tracing with the planimeter, the distance *hk* measures .21 inch and *ks* measures .42 inch. Then $ks = \frac{1}{2}hk + ks = .105 + .42 = .525$ inch. The area of the diagram is $10 \times .525 = 5.25$ square inches. The mean ordinate is $5.25 \div 3.5 = 1.5$ inches, and assuming a 60 spring to have been used in taking the diagram, the mean effective presure is $60 \times 1.5 = 90$ pounds per square inch of piston area.

It will be observed from the foregoing that the construction and use of the hatchet planimeter are simple matters, and that by taking proper care the results obtained will be fairly accurate.

It has been suggested by some that an ordinary large pocket-knife may be made to serve the purpose of a hatchet planimeter by using one blade as the recording or hatchet end and the point of the other blade as the tracing point, Such a substitute is certain to introduce considerable error. In the first place, the point of the blade used for tracing will not lie in the plane of the other blade, which is one of the points essential to accuracy. Again, the point of contact of the recording blade, or hatchet, will not be easy to determine with precision, and consequently the length

of the planimeter will not be exact. Furthermore, it is difficult to have a pocket-knife so rigid that the distance between its blade points will not change. Any alteration in this distance while using the knife as a planimeter will affect the accuracy. Hence, except for very rough work, the pocket-knife has nothing but its simplicity to recommend it as a substitute for an accurately made hatchet planimeter.

PRINCIPLES OF MECHANICAL DRAFT

Comparison of the Steam Jet, Forced Draft and Induced Draft

By L. N. Daney.

Since the earliest days of steam being used as a motive power both for marine and locomotive work, the advantages of mechanical draft have been keenly felt. In both cases the massive chimneys necessary to produce sufficient natural draft were impracticable. Many systems were adopted, until at the present time the fan system in one or another of its forms is almost universally used. Mechanical draft for all types of boiler construction now stands so well established that a noted engineer has said that "the building of tall chimneys to secure draft simply advertises the owner's lack of familiarity with modern improvements, or his want of confidence in results easily demonstrated."

Before reviewing the commoner methods of producing mechanical draft and their respective merits it might be well to consider what is meant by draft, its principle as applied to chimneys and the disadvantages of natural or chimney draft in modern practice.

The production of draft in the chimney depends upon the fact that the temperature of the furnace gases or products of combustion is considerably higher, and therefore of lighter weight than an equal volume of air at the temperature of the surrounding atmosphere. The pressure within the chimney is therefore less than the pressure of the outside air, causing the air to flow from the place of higher pressure to that of lower pressure or into the chimney through the furnace. It is therefore evident that the draft depends upon the temperature of the waste gases and the volume of the air column encased by the chimney.

The intensity of the draft depends upon the difference in weight of the gases in the chimney to the weight of a similar column of air at the temperature of the surrounding atmosphere. For example, if the column of gas in the chimney weighs 6.5 pounds per square foot of base area and a similar column of the outside air weighs 11 pounds, the intensity of the draft would be 4.5 pounds per square foot. This intensity is usually spoken of as corresponding to a pressure of a certain number of inches of water. In the example given, the draft would be spoken of as equivalent to $(4.5 \times 2.31) \div 12 = .866$ inches of water. The intensity ordinarily used varies from ½" to 3", depending upon the coal or fuel used.

The economy and efficiency of the boiler depends closely upon the draft and the amount of fuel consumed. If the draft is bad, the fuel has to be spread in thin layers upon the grates, and in consequence large volumes of air pass through the fuel without combining with the carbon. This uncombined air is not only useless, but harmful, as it lowers the temperature of the fire and overloads the chimney, thus diminishing the intensity of the draft. With sufficient draft the fuel can be used in thicker layers, as the draft is strong enough to overcome the resistance of the thick bed of fuel. The advantages of the thick fire are, almost complete combustion and a higher furnace temperature.

The primary object of draft is therefore to obtain complete combustion of the fuel with the least excess of air beyond the amount required for actual combination with the constituents of the fuel. When the air supply is limited or the draft poor, the carbon of the coal or fuel combines with only one atom of oxygen forming carbon monoxide, which combination gives off only 4,500 British thermal units. Had sufficient air been alllowed for complete combustion, carbonic acid gas would have been formed, giving off 14,500 B. T. U.'s. This comparison shows the enormous waste due to incomplete combustion.

If, on the other hand, more than enough air to insure complete combustion is admitted to the furnace, a direct loss of heat occurs. The excess of air admitted at atmospheric temperature rapidly absorbs heat from the gases, and as the heat extracted from the heating surface of the boiler depends directly upon the difference in temperature between the products of combustion and the water, and as the temperature of these products is decreased owing to the excess volume of air, it follows that the efficiency of the heating surface is reduced and that a great proportion of heat is wasted by the flue gases. From these illustrations the importance of the exact amount of air or draft necessary for economical fuel consumption is readily seen.

The following are a few of the more prominent disadvantages to natural draft and ones which are readily overcome by mechanical draft. In order to obtain the greatest draft by natural means or by the chimney, the temperature of the flue gases must be very high. The heat thus dissipated is a direct loss. Any attempt to utilize a portion of this waste by means of an economizer or any similar device, necessarily reduces the temperature and lessens the draft. The only way of making good this lowering of temperature is to increase the height of the chimney, which means an enormous expenditure of money. The first cost of high chimneys is considerably more than the cost of an equally efficient mechanical system.

A third bad feature of natural draft is the inability to add more units or boilers to the system without proportionately increasing the size of the chimney. With the mechanical system a slight increase in the speed of the fan readily increases the draft obtainable. Weather conditions also have their effect upon the natural draft and therefore upon the efficiency of the boiler.

Draft is produced mechanically by one of the three gen-

eral methods: By use of the steam jet, by what is known as forced draft, and by induced draft.

Inasmuch as the steam jet usually requires for its operation five to ten times as much steam as does the fan, its relative economy is not especially great and will therefore not be particularly dwelt upon. In locomotive practice the exhaust steam is used in inducing a draft by exhausting in the combustion chamber and by virtue of its velocity creates a partial vacuum in the flues and combustion chamber.

Forced and induced draft are now almost universally produced by the fan system. The former by forcing air into an air-tight fire room, as in steamship practice, or by forcing air into an air-tight fire-box. The latter system is used almost entirely in stationary boiler practice. Induced draft is produced by placing a fan in the up-take, producing a partial vacuum in the fire-box, causing a rush of air at atmospheric pressure through the grates.

The forced or induced systems have no particular advantage over each other unless it lies in the life of the system itself. In the forced system the fan handles only cool air, and its life will, under ordinary conditions, be as long as the other boiler attachments.

If the fan is used to exhaust the gases, as in the induced system, it is subjected continually to very high temperatures and to produce the same draft as the forced system, will have to be run at a higher speed, due to the decreased density of the gas. The products of combustion often have a deleterious effect upon the steel plates of which the fan is constructed.

As a final summation, mechanical draft costs less for installation than a chimney; it is essential in the utilization of the waste heat of the flue gases; it is capable of decreasing the fuel cost by using cheaper grades of coal; it is independent of weather conditions, and is able to meet sudden or excessive demands for more steam.

It is therefore no longer a prediction that mechanical draft for various purposes is essential to economical steam production and that massive chimneys may become conspicuous by their absence from power plants.

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The presence of any considerable amount of oil or water in a refrigerating system, which may result from careless distillation, will cause a reduction in efficiency of the system, and will be evidenced by shocks within the compression cylinder.

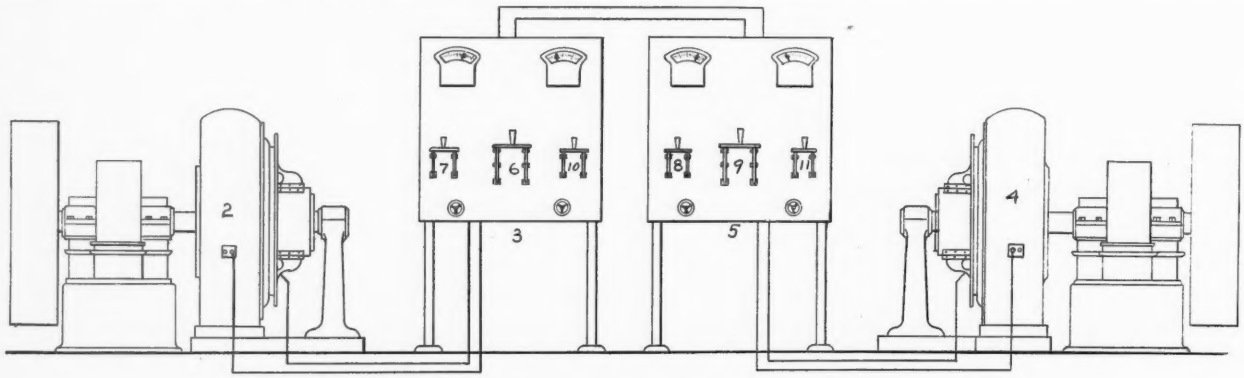
Two Switchboards Connected, for Convenience of Operation.

By W. H. Wakeman.

The illustration shows two engines and dynamos, each with its own switchboard, that are used independently when there is sufficient call for electric current to warrant it, as they belong to two separate systems, but both use direct current at 110 volts potential. When so used the dynamo 2 supplies the switchboard 3, while 4 sends current to 5, but when only a few amperes are wanted for each, only one engine is run.

For illustration, 4 may be shut down while 2 supplies all that is wanted. The main switch 6 will then be in, also 7, which gives current to the connecting wires above the switchboards, while 8 is in to deliver current to the bus-bars of 5. The other main switch, 9, must be out, but 10 and 11 are in to distribute current to various points.

If 2 is shut down, then 4 sends current to 5, and the main switch 9 is in, also 8, 7, 10 and 11, but 6 must be out. While doing this, care must be taken to see that 6 and 9 are never in together, as it would throw current on to an idle dynamo, which is not advisable.



Two Switchboards Connected for Convenience of Operation

The illustration shows two connected units that are practically alike, which is not strictly correct, as they are run under entirely different conditions, an explanation of which would require several illustrations and more or less reading matter that is not necessarily connected with the subject that I wish to present. These peculiar conditions make it impracticable (not impossible) to run these dynamos in parallel, thus requiring much more care and attention than would be necessary if the machines were alike, run at the same speed, and it was possible to hold the voltage steady.

———o———

Six Different Types of Furnaces Will Be Sufficient to Burn Any Coal in the U. S. Without Smoking.

A solution of the smoke problem that is simplicity itself has been laid before the director of the Geological Survey by the engineer in charge of the Steam Engineering Department of the Survey, Professor L. R. Breckenbridge, who is also of the faculty of the University of Illinois. Professor Breckenbridge has conducted his experiments on smoke prevention at the latter institution, and after two years of work and careful observation of results, he declares, he has demonstrated beyond question that the smoke evil in cities can be easily and quickly done away

with by a very simple expedient. This is to have furnaces or fire-boxes so constructed that the flames from the burning coals will never touch the boiler.

"The essential thing," Professor Breckenbridge says, "is to have the boiler so placed that the flame from the coals doesn't touch it. The flame striking the boiler prevents a proper and complete combustion and results in making smoke. Light a candle and it will burn without smoke; place a saucer in the flame and there will be plenty of smoke. So it is with the fire under the boiler.

"Of course," Professor Breckenbridge is quoted as saying, "different coals will give different length of flame, according to the amount of volatile matter they contain. This means that the distance between the boiler and the grate must vary to suit the coal used. But I am of the opinion that six different types of furnaces will be sufficient to burn any coal in the United States without smoking. We are able to tell the amount of volatile matter in coal by chemical analysis, so if a manufacturer learns the chemical content of his coal he will discover the length of flame it will make in burning and adjust his furnace accordingly. Hundreds of chemical analyses of coals have been made by the technological branch of the Geological Survey, and it will keep the work up until we know every coal in the United States. Then there will be absolutely no excuse for smoke anywhere.

"Another point I should mention is that so long as there is hand-firing, the smoke nuisance will not be completely done away with. Mechanical stokers must do the work if there is to be perfect combustion and the coal used must be nearly uniform in size."

In his experiments at the University of Illinois, Professor Breckenbridge operated the heating plant of 2000-horse power for two years without smoke and at a saving of $5000 a year over carelessly-managed commercial plants. One boiler was so well constructed and managed that it was practically impossible to make it smoke, even when special efforts were put forth to do so.

Making an Artesian Well Pump Itself.

The field men of the United States Geological Survey, in their investigations of the ground-water resources of the Virginia Coastal Plain, have observed that the flows from many artesian walls in that region are utilized to drive hydraulic rams for the purpose of lifting the water to higher levels. Along the lower courses of the Potomac and Rappahannock and along the shores of the many inlets that run back from Chesapeake Bay above the James, there are hundreds of artesian wells that supply a perennial flow of beautifully clear water which is, as a rule, excellently adapted to all domestic uses and is largely utilized by the canning factories and other industrial establishments that abound in that part of the country. Though the pressure of the water from the wells is ample at the shore level, the head diminishes so quickly with increase in elevation that no flow can be obtained along the higher banks above the shores, where the water is most needed. The common method of obtaining it at these higher levels is to use the force developed by the artesian flow to operate hydraulic rams, which in turn raise the water to the heights desired along the bluffs above the rivers and inlets. Thus it may be said that the artesian wells pump themselves.

Electrically Operated Valves.

The electrically-operated valve is a mechanical refinement demanded by the size of recent hydraulic and hydro-electric developments, where the necessary control of vast volumes of water requires valve openings which it would be practically out of the question for the station attendants to operate without the application of power.

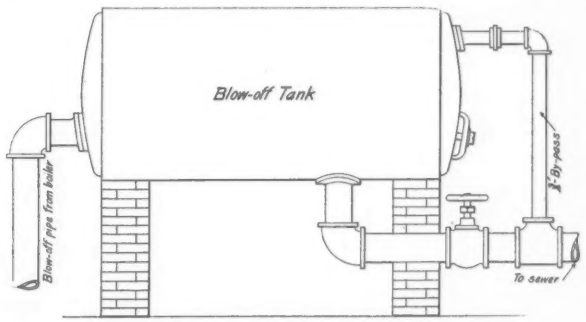
About 120 miles from the city of Los Angeles, Cal., on the canyon of the Kern River, a new power house just being completed by the Los Angeles Edison Company is practically ready to supply electric power to the city from approximately 43,000 horse power in horizontal water wheels.

The power plant will be equipped with valves electrically operated by means of eight Allis-Chalmers direct current motors. They will be used on 28" gate valves. Those motors are of the vertical type, series wound, 4 H. P. each. They are totally enclosed and so arranged that they may be controlled directly from the power house.

A Practical Blow-Off Tank.

By Walter J. McKnight.

When blowing down boilers under pressure, the accompanying sketch will show an arrangement which should prove useful to the practical engineer. The tank is set above the floor where it is easily accessible and is arranged with a ¾-inch by-pass leading from the top of the tank to pipe leading to sewer. When the boiler is being blown down under pressure,



Piping for Blow-Off Tank

close the valve in pipe going to sewer. The ¾-inch by-pass will relieve the tank from high pressure, and at the same time will not damage the tile sewer. The ¾-inch by-pass also does away with a vent pipe going to the roof. After closing blow-off cock on boiler, open valve going to sewer; this will always leave the tank dry and the mud will be found in the end near the manhole.

Asbestos, Used Extensively as a Non-Conductor of Heat, Insufficient to Supply the Demand.

Commercial asbestos, which is being used extensively for various purposes is found in two distinct forms of fibrous minerals, actinolite or tremolite, and chrysolite, the latter being the most important fibrous variety.

The eastern townships of the province of Quebec furnish the greater part (85 per cent.) of the world's production of

asbestos. In 1906 Canada exported 59,864 tons of asbestos, valued at $1,629,257, most of which came to the United States. Improved methods of mining are being introduced in Canada, and the output there is increasing.

Both forms of asbestos are applied to many uses, depending in part upon the fibrous character of the material, but also upon its non-conductivity of heat and electricity. The best grade of chrysolite fibre is spun into thread, yarn and rope, and woven into cloth. The yarn is largely used for packings and the cloth for theatre curtains, while fabrics containing asbestos woven with other fibres are made into various household articles in which heat insulation rather than fireproof character is required.

Asbestos is extensively used for plastering and for making lumber that is employed in buildings where insulation against fire and electricity are desired. Its use in fireproof structures, and especially to envelop electrical conductors, is constantly increasing.

The production of asbestos in the United States in 1906 was 1,695 tons, valued at $28,565, as against 3,109 tons, valued at $42,975, in 1905. The imports in 1906 were valued at $1,076,170.

The output of all existing asbestos mines is insufficient to supply the demand for this product, and the leading manufacturing firms interested in the industry are diligently searching for new deposits.

Merits of Coal and Gas to Be Tested By the U. S. Fuel-Testing Department.

Experiments with eastern and southern coals for the purpose of husbanding the coal supply of the country will begin at Norfolk, Va., on August 15, under the auspices of the fuel-testing plant of the United States Geological Survey.

For two years this plant was in operation at St. Louis, and so encouraging were the results in the direction of preventing the waste of the fuel resources of the country that Congress ordered the work to be continued at Norfolk. Coal from the bituminous mines of Pennsylvania will be used in these experiments. Already the government experts connected with the plant have indicated the possibility of saving 10 per cent. of the country's coal bill each year—the sum of $160,000,000—through increased efficiency in burning coal. Now the fuels of the East and South are to be tested under the steam boiler, in the gas producer and gas engines, and by briquetting, in the hope that this saving may be further demonstrated.

The plant is located not far from the main entrance gate of the Jamestown Exposition, and already has attracted thousands of visitors, many of whom were manufacturers interested in the economy of fuel.

Under the plan which the fuel-testing plant is to be operated, two classes of work are contemplated—increasing efficiency and preventing waste in the utilization of the fuel resources of the country, and testing coals that are used by the government.

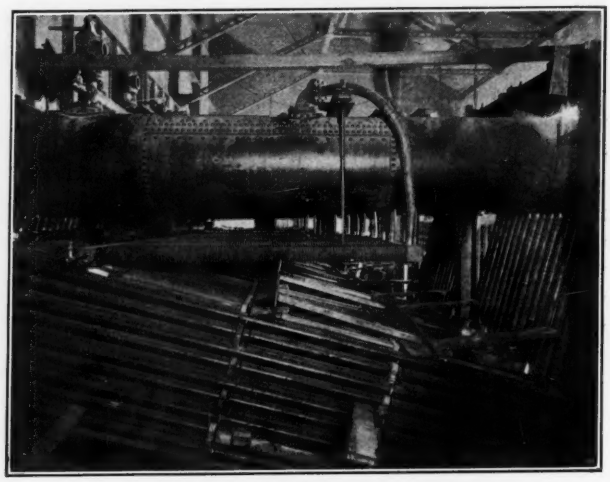
Perhaps the most important tests will be those comparing the amount of power obtained from a certain amount of coal under the steam boiler and in the gas producer. The gas engine has demonstrated in former tests its ability to do from two to nearly three times as much work with a pound of coal as the steam engine.

There will also be a series of experiments tending to show just what is necessary to burn these coals without smoke.

A considerable portion of the fuel-testing plant is to be given over to testing fuels for the navy, and the entire briquetting plant will be at its service.

Superheaters at Washington Naval Gun Factory.

The acompanying illustration shows the construction and arrangement of about a score of superheaters installed at the Naval Gun Factory at Washington, D. C., which are of most interesting and unique design.



Superheaters at the Naval Gun Factory, Washington, D. C.

These superheaters of the Foster type are designed and constructed in standard elements as shown in the illustration, the horse power of each boiler and superheater is 300. The pressure maintained is 200 pounds per square inch and the superheat 120 degrees F. Forged steel headers are used in the construction and the location and arrangement of these superheaters in the boilers between the stam drums and the boiler tubes is well shown in the accompanying view.

Direct Leakage of Steam Through Slide Valves.

When the weight of steam used in an engine, as determined by condensing the exhaust, is compared with that computed from the indicator card, it is well known, says J. V. Stanford, in "Journal of the Franklin Institute," that there is considerable difference in the results. This difference between the actual and computed weights, commonly called "the missing quantity," and in some cases amounting to as much as 50 per cent. of the steam used, is generally considered as being accounted for by condensation in the cylinder. The indicator card shows only the actual weight of vapor in the cylinder at a given time, taking no account of the steam which has entered the cylinder and has been condensed by transfer of heat to the cylinder walls. There is no doubt that a large part of the missing quantity may be charged up to cylinder condensation, but there is a possibility that some of it may be due to another cause, namely, valve leakage.

Experiments have been made at the Mechanical Laboratory of the University of Pennsylvania, to determine some facts in connection with leakage of slide valves. A set of tests was made on a 6-in. x 9-in. Sturtevant blower engine, driving a three-quarter housed centrifugal fan keyed direct to the shaft. The engine and fan had been installed in the boiler house of the university to create forced draft, and after a short period of use had stood idle with only an occasional run when used by the students for practice in valve-setting. The engine has no governor, depending upon the throttle and the steady resistance of the fan to maintain the proper speed, and the valve is driven direct by the eccentric through a rocker arm. The valve is of the common D slide valve type, 5 inches wide by 4¾ inches long, overlapping the ends of the ports ¼ inch on either side. The engine had evidently been designed to work with the cut-off fixed at about 0.65 of the stroke, and during the tests the valve was set to give this cut-off. With this setting the minimum width of bridge covered by the valve was ⅝-inch, so that the exhaust port was everywhere protected from direct leakage by contact between the valve and seat at least ¼ inch in width.

A balance plate extends between the valve and chest cover to relieve the pressure between the valve and seat, and reduce the resulting friction. The balancing device consists of a cylindrical cup, bearing against a circular boss on the chest cover, and telescoping over a cylindrical projection from the top of the valve, the telescoping joint being made tight by two split rings. Contact is maintained between the balance plate and chest cover by four light springs. Steam leaking through the packing rings to the inside cavity of the balance plate is discharged through two 3/16-inch holes in the top of the valve direct to the exhaust cavity, so that the pressure over a large part of the valve is exhaust pressure. This leakage is also part of the missing quantity, for it goes to the condenser without affecting the indicator card.

In preparing for the tests, the engine exhaust was piped to a surface condenser, and arrangements made for collecting and weighing the condensation; a pressure gauge was attached to the steam chest, and a revolution counter geared to the eccentric strap. Indicator cards were also taken. Two runs were then made with the engine working normally under the load of the fan with the balance plate on the valve, and readings were taken to give the weight of steam condensed, revolutions per minute, pressure in the steam chest and the indicated horse power. Average results from the two tests showed that the engine was developing about 5.13 horse power and was using about 91.2 pounds of steam per indicated horse power per hour.

The balance plate was then removed from the valve, the holes through the top of valve plugged with wood, leaving the valve unbalanced, and tests run as before. These tests gave a steam consumption of 60.5 pounds per indicated horse power per hour, or 30.7 pounds less than when the balance plate was in place, due to the difference in leakage. In the first case, the leakage was through the balance plate and under the valve; in the second case, under the valve only, but the difference was due not so much to leakage through the balanced plate as to the fact that in the first case the valve was only slightly seated while with the balance plate removed it was seated firmly by the whole pressure of the steam, and a good joint maintained with the seat.

In order to determine the actual amount of leakage the steam ports of the engine were plugged by driving in blocks of dry white pine, filling the steam passages flush with the valve seat. One cylinder head was then removed and the stuffing box opened to relieve any pressure in the cylinder due to leakage through the plugs. The eccentric sheave was loosened on the shaft and bolted to a large wood pulley placed beside it. The pulley was belted to a one-horse power electric motor, geared to drive the pulley and eccentric about the shaft at the same speed as had been used in the previous tests. Having thus reproduced the conditions of the running of the valve as nearly as possible, except that all passages of steam to and from the cylinder were eliminated, it was fair to assume that all the steam now reaching the condenser was due to leakage from the chest to the exhaust, and that the amount was practically the same as when the engine was running normally. In running these tests, the motor was started and adjusted to the proper speed, then the throttle valve was opened carefully until the pressure in the chest was the same as in the other tests. A test under these conditions, with the balance plate on, showed the leakage amounting to 43.9 per cent. of the total steam consumption.

As stated before, the engine had been standing idle for some time, and the valve and seat were not in perfect order, but their condition was not unusually bad, for when tested in the ordinary manner by opening the throttle with the valve standing still over the ports, only a trifling leakage was apparent, which makes it appear that the standing test for leakage, so commonly used, is a very poor index of what may take place when the valve is running.

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Asleep on Dynamo Belt, Assistant Fireman is Crushed.

Going to sleep on the large dynamo belt at the Burlington County Railway Company's electric power plant, near Mt. Holly, N. J., Justus Sutliff, aged 19 years, an assistant fireman, selected a resting-place that proved to be his death-bed.

After the power had been shut off at 1.30 A. M., Sutliff had nothing to do until starting time at 5, so he jumped over the guard rail around the machinery and went to sleep on the belt. His dangerous position was unknown to the engineer, and when the power was turned on at 5 o'clock an agonizing groan was heard. The engineer shut off the steam and an investigation revealed the lifeless form of Sutliff, wedged between the 3-foot belt and 20-foot fly-wheel, his head and part of the body a flattened mass. It was necessary to slacken the belt to remove the body.

—o—

Injured While Starting Gasoline Engine.

While starting a gasoline engine at the Seabright Wall Paper Factory at Wheeling, W. Va., John Biehl, the engineer, had a narrow escape from death. As it was, he was badly burned by an explosion of the gasoline, which ignited and threw its fiery fumes in all directions. The engine was being started preparatory to its daily run.

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Power Plant Repairs.

The exacting service which is being demanded of large steam power plants has caused many of these plants to have installed in them a power-plant machine shop, which is under the control of one man, who is a thorough machinist, and whose duty it is to have charge of all repairs required around the engine and boiler room. While every power plant of any size has a more or less complete machine shop equipment, it has not been until recently that steps have been taken to specialize this work, so that the responsibility of making repairs is taken out of the hands of the running engineer, who may not be acquainted with all the newest types of lathes, drill presses, milling machines, planers, etc., or who may not know all the numerous "kinks" necessary for the quick and accurate results which must be obtained. Under this sytem, the running engineer has more time to devote to looking after the machinery under his charge and he will often become more exacting in demanding repairs than if he knew he had to make them himself, when opportunity afforded it.

The advent of the steam turbine has been one of the chief factors in promoting the use of thoroughly equipped power-plant machine shops, because the economy of a steam turbine plant depends almost directly upon the degree of vacuum carried by the condensers. If an inch or two of vacuum is lost, the steam turbine loses much of its economy, and consequently, dry-vacuum pumps, wet-vacuum pumps, condensers, valves and condensers must all be kept in a state of highest efficiency. With a reciprocating engine, it does not matter such a great deal whether the vacuum carried is 28 or 24 inches, but with a steam turbine such a drop in vacuum would not be tenable. Consequently, since the economy of a turbine plant depends upon its degree of vacuum, and since the vacuum depends upon the state of efficiency of the condenser and its auxiliaries, it is necessary that each piece of apparatus be kept in the highest state of efficiency in order to maintain that vacuum.

It is very doubtful, however, whether, except in large steam turbine plants, it is a paying investment to install a large amount of machine shop tools and equipment, which must usually be motor driven, or driven from some auxiliary. Of course, in cases of breakdown it is very convenient to have a complete machine shop equipment at command, but in the ordinary running of a plant, the cost of keeping up a complete machine shop equipment may more than eat up what might be saved by keeping every part of the machinery in perfect condition.

While, of course, even the smallest of plants should have adequate tools and machines with which to make general repairs, yet, at the same time, there is such a thing as overburdening the engine room expense account with costly machine shop equipment. There are usually, except in isolated places, machine shops on which reliance can be placed, and the fact that these shops employ experts in their respective lines insures that the different line of repairs wil be done in the most up-to-date manner.

In this twentieth century age of specializing, one machinist is only required to understand one particular kind of work, and while he should know in general how to operate every machine in the shop, yet the most proficient men are those that are specialists. The same thing is true of an engineer.

It is almost impossible for one man to thoroughly understand all the various duties which must be performed around a large plant. To be sure, he should understand how to repair, as well as operate the various equipment under his charge, but it is not necessarily imperative that he should do every bit of work with his own hands. Therefore, unless a power plant machine shop employs experts in their respective lines, much of its value is lost by one man having to do a great variety of work.

The equipping of a power plant with the necessary tools and machines is a step in the right direction, but it is possible, from a financial point of view, to carry this tendency too far. The machine shop should always be a necessary adjunct to the power-house, but there is a point where their relative proportions should balance.

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Increased Use of Aluminum Wires.

The recent decline in the price of copper from 25 cents a pound to 16½ cents a pound, due to the fact that copper consumers considered the former price too high and refrained from buying it, brings to mind the fact that during the era of high prices many substitutes for copper were tried in the electrical industry with more or less success.

One of the metals which has been used with considerable success in the transmission of high voltages has been aluminum, and it is now being used on some of the most important high-tension transmission lines in this country. For instance, from Niagara Falls to Buffalo there are two three-phase circuits of aluminum wire used to transmit 22,000 volts about 22 miles. This wire has a cross section of 500,000 circular mils and a diameter approximately of 0.8 of an inch. These two circuits are used in conjunction with two other circuits using copper wire, which has a cross section of 350,000 circular mils, or a diameter of approximately 0.7 of an inch. From Niagara to Tonawanda, Lockport, Olcott and Fort Erie, current is also sent on a 500,000 circular mil aluminum cable, and many of the long-distance transmissions in the West make use of the silvery metal as a conductor of high voltage alternating current.

When the price of copper rises above 16 cents a pound for bare wire, it has generally been considered that aluminum wire is the more economical, and it has been due principally to this fact that aluminum wires have been used.

Aluminum has about six-tenths the conductivity of copper, but owing to its low specific gravity, its conductivity is higher than copper when compared on the basis of weight. For aluminum to possess the same conductivity as copper it has to be about one-half the weight of copper, so that if copper wire is 16 cents a pound, aluminum wire would be equally economical at 32 cents a pound.

When it comes to tensile strength, aluminum is only slightly less strong than copper, but comparing wires of equal conductivity, aluminum has the greater strength because its cross-section is larger than that of copper wire. Being somewhat larger, however, aluminum has more inductance and capacity than copper, and has more area which is exposed to storms. When stringing aluminum wires more care must be taken, as it has a greater tendency to sag and contract. Aluminum wire joints are also said to be more liable to attack from corrosion, but with properly designed connector sleeves, which do not have to be soldered, or which are soldered under considerable pressure, it is said that they give no more trouble than copper joints.

Considering the large investments which are being made in electrical conductors, especially when the transmission lines run several hundred miles, it is not to be wondered that other metallic conductors have to be used, especially when copper is selling at almost prohibitive prices.

—o—

Control of Water Powers.

Action has recently been taken in Germany which is likely to have momentous consequences in connection with the industrial development of the country, and will be watched with great interest by other lands whose industrial conditions are at all analogous. This action is embodied in a Bavarian law claiming as property of the State all available sources of hydraulic energy within the kingdom, and is in line with the previous Prussian legislation making all coal fields to be discovered in the future government property. In Bavaria, however, where there is no coal, the excuse for the enactment is the necessity under which the State rests to insure an adequate supply of power for the State railways when they shall be electrified—which is regarded as only a matter of time. An inventory of water powers is already being made, and a commission is studying all the utilization projects that have been brought forward, and will report on them next fall.

Recent experience in this country, in connection with the Niagara and other power projects, the steadily increasing cost of coal and the perfection of hydraulic power transmission methods, make the whole question of the control of water powers one of the highest possible importance. The cost of fuel and the development of electrical science have together so greatly enhanced the value of water power that the field is being scoured for available sources. In some cases water rights in what now seem to be remote districts have been pre-empted, and the time will not be far distant when, unless there shall be some regulation on the subject, the hydraulic power supplies will be as effectively centralized as are the existing anthracite coal deposits.

Whether government ownership and control are justifiable, even in the cases of the country's fuel and power supplies, is a complex question. Some of the German States have decided it affirmatively, but in this country there will be increasing pressure for the adoption of a policy that will protect the rights of the public as well as of those who have the skill, the resources and the enterprise to utilize and develop latent forces now going to waste. The obvious duty in this country is the serious study of the problem while effective control and regulation are still possible. It by no means follows that the "nationalization of water powers" is necessary or desirable, but the question is a serious one and deserves greater attention than is being given to it.

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Foundation bolts for an engine or generator should be located accurately as shown on the foundation plans furnished by the builder and a space of at least one inch should be left all around them to allow for adjustment after the frame, rails or timbers are in place.

LETTERS FROM ENGINEERS

IN ORDER to make this department of THE PRACTICAL ENGINEER as interesting as possible, a moderate rate will be paid by us for all contributions published under this heading. However, we do not assume responsibility for the ideas or opinions expressed. None need hesitate to contribute because of inability to draw or write well. We will redraw or revise whenever necessary—it is the idea we want. New ways of doing old things, criticisms of accepted theories, and general engine-room experiences are especially solicited.

Answer to T. S.'s Condenser Problem.

EDITOR THE PRACTICAL ENGINEER:

In answer to T. S. who claims that it does not take any more steam to pump the condensing water out of the wheel-pit than it does out of the tank, I would say that it undoubtedly takes more power to raise water 12 feet than it does to take it from a level with a pump.

As T. S. does not give the size of the pump or of the suction pipe, we will assume the pump piston is 20 inches in diameter and the inside diameter of the suction pipe to be 10 inches. The suction head is 12 feet which gives a suction pressure of 5.20 pounds per square inch. The pump piston being 20 inches in diameter, the piston area is 314 square inches and $314 \times 5.2 = 1632.8$ pounds of suction or pull on the piston. Assuming that the pump makes 40 strokes per minute, each stroke 2 feet long, the pump does $1632.8 \times 40 \times 2 = 130{,}624$ foot-pounds per minute, or $130{,}624 \div 33{,}000 = 3.9$ horse-power. It can therefore be seen that it will require about 4 horse-power more work to pump the water from the wheel-pit than from the tank, neglecting friction of the pump and piping.

Furthermore, T. S. says that if he puts a vacuum gauge at A in his sketch it will show zero when the pump is carrying 25 inches of vacuum. I wish to say to T. S. that the gauge will show the same vacuum as is on the pump provided he has no air leaks between the pump and the gauge.

Des Moines, Ia. A. C. B.

T. S.'s Condenser Arrangement Will Not Increase Steam Consumption.

EDITOR THE PRACTICAL ENGINEER:

In answer to T. S. who wants information about his condenser suction pipe, I would like to give the following explanations:

The condenser pump uses steam to expel the air from the exhaust pipe, suction pipe and condenser. Atmospheric pressure is what forces the water up the suction pipe into the condenser and after the air has been expelled, it takes no more steam for the pump to draw in the injection water. All the pump has to do is to discharge the water and condensation from the condenser.

Therefore, as long as the discharge pressure remains the same, the pump will take the same amount of steam, either way the suction pipe is arranged, because it is the atmosphere and not the pump that raises the water to the condenser.

The only objection to any change as proposed by T. S. is the increased height of the suction pipe. Suppose that for any reason the vacuum should fall, in which case the pressure of the atmosphere would not then be sufficient to force the water to the condenser. Should it fall so low that the pressure in the condenser plus the weight of the column of water in the suction pipe equals the pressure of the atmosphere, he will lose his vacuum.

However, as each inch of vacuum will support a column of water 1 2/15 feet high and as T. S. has 26 inches of vacuum, he could theoretically use a pipe about 29½ feet high, provided he can maintain 26 inches of vacuum. In practice, however, it is unusual to use a pipe with more than 20 feet vertical lift. T. S. with his proposed arrangement will have a vertical lift of 18 feet and at this height the atmospheric pressure will raise the water up the suction pipe with a vacuum of only 16 inches, neglecting the friction in pipe and loss in pressure due to elevation above sea-level, thus showing that the atmospheric pressure will raise the water up T. S.'s suction pipe after the change is made fully as well as with the present arrangement, besides getting better water.

If T. S. wishes to prove to his chief that it does not take any more steam, I would suggest placing a steam gauge on the steam pipe close to the pump and count the strokes per minute for several minutes both before and after the change is made. If the steam pressure remains the same, he will find that the speed is the same, thus proving that the steam consumption is not increased by the change.

Barton, Vt. A. O. W.

Lost Motion of Pump Valves.

EDITOR THE PRACTICAL ENGINEER:

The following will answer J. C. H.'s questions in the September issue:

1. A pump valve is given lost motion because it allows the steam pistons to be at rest for a short time at the end of the stroke and at the same time allows the water valves to seat quickly.

2. The valves should have 3/16" lost motion on each side when the pistons are in mid-position and the valves placed central over the ports.

The best way to test the equal division of the lost motion is to move each valve each way until it strikes the nut and then see if the port openings are equal. When the port opening has been equalized, the valves are set. Too much lost motion will tend to lengthen the stroke and may cause the pistons to strike the heads, while if there is not enough lost motion, the stroke will be perceptibly shortened.

The proper amount of lost motion for a given length of stroke can only be found by trial for each particular pump.

Benson, Minn. F. J. D.

Lost Motion of Pump Valves.

EDITOR THE PRACTICAL ENGINEER:

In the September issue, J. C. H. asks: "Why is a pump valve given lost motion; how much should it have and how can it be found?"

The lost motion is given to secure the rest period at the

end of each stroke, which is needed for quiet running and small slip. How much it should have depends upon the size of the stroke, usually from ⅛ to ⅜ inches is allowed for pumps up to 10 inches stroke, the larger sizes requiring from ½ to 1 inch. The amount needed can only be found by trial, but once fixed will be the same for all pumps of a given style and size.

Des Moines, Iowa. A. C. B.

Answers to J. C. H.'s Questions.

EDITOR THE PRACTICAL ENGINEER:

On page 25 of the September issue, J. C. H. asks some questions, which are answered as follows:

1. Why is a pump given lost motion? *Ans.*—To enable the pump to start off and to allow the piston or plunger to complete the stroke after the valve has stopped.

2. How much lost motion should it have? *Ans.*—One-half the width of port divided equally on each side of the nut.

3. How would you find the required amount? *Ans.*—If the pump short-strokes, there is not enough lost motion; if the piston strikes the cylinder heads, there is too much lost motion. A medium between the two will be the proper amount. W. H. E.

St. Louis, Mo.

Lost Motion of Pump Valves.

EDITOR THE PRACTICAL ENGINEER:

In reference to the queries of J. C. H., of Elyria, Ohio, in the September number, about the "lost motion of pump valves," I would reply as follows:

The lost motion of the steam valves referred to, is given in order to have the valve open at the proper time, with regard to the steam piston movement; to allow the ports to remain open sufficiently long to obtain the longest possible piston stroke without striking the cylinder heads; and to allow the valve to close at the proper time.

Just how much lost motion should be given depends upon the size and design of pump. I do not think there is any rule that would suit any and all cases without modifications, although I have seen it stated that good results can be obtained by giving the valve lost motion to the extent of one-half the width of the steam port. Perhaps some one found that the rule worked all right in his individual case and took it for granted that it would apply to any or all pumps that have "lost motion" (so to speak) valve gear. I do not say that the rule in question will not answer but I think that the amount of lost motion, in a given case can best be determined by trial.

If too much lost motion be given the valve, the pistons will strike the cylinder heads; if too little be given, the pistons will "short-stroke," so that somewhere between these extremes there will be an amount of lost motion that will permit of the pistons travelling the correct distance.

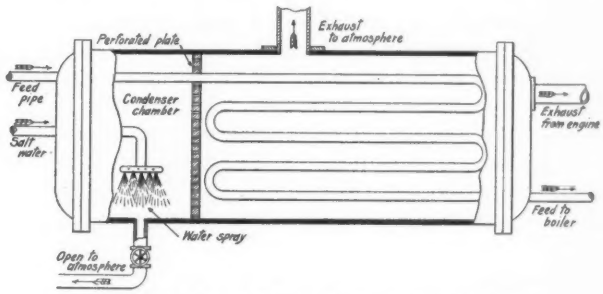
A few trials will show just how much lost motion will be required. In starting out, allow the pistons to strike the heads, easily of course, by carefully working the throttle, and then work from that point by reducing the amount of lost motion until the pistons will not strike.

Scranton, Pa. C. J. M.

Combined Feed Water Heater and Condenser.

EDITOR THE PRACTICAL ENGINEER:

As a recent subscriber to your valuable paper, I must say that I am very much pleased with it. I consider it equal, if not superior to any of the papers for which I have paid 20 cents a copy. I enclose a sketch of a feed water heater which was submitted to me by a master mechanic. He claimed that the condensation of a portion of the steam in



Combined Feed Water Heater and Condenser

the condensor chamber would relieve the engine of some back pressure. The steam goes through the perforated plate (at least a portion of it does) thus creating a partial vacuum by being condensed when coming in contact with the jet of cold water. I fail to see, however, how such an arrangement could possibly be of any use as a condenser, but would like to hear what some of the readers think about it.

Victoria, B. C. J. E. M.

Not Enough Compression Causes Pound in C. N. L.'s Engine.

EDITOR THE PRACTICAL ENGINEER:

In answer to C. N. L.'s question regarding the pound in his engine, I would say that compression takes place too late on both the forward and return strokes. By lowering the vacuum to stop the pounding, as he did, the compression was increased. There will be more economy if he increases the compression and carries a high vacuum.

It also appears from the cards, that admission is too early, causing the pressure in cylinder to rise higher than the initial pressure.

Phoenix, Ariz. J. M. I.

One Pump Trouble Solved, But What Caused the Packing Trouble?

EDITOR THE PRACTICAL ENGINEER:

Sometime ago I asked a question in reference to a 6½" × 5" × 6" Snow pump which pounded badly. In the March issue of The Practical Engineer, one of our friends, Mr. J. R. W., answered this question. Since that time I have found out the trouble, and I wish to inform him of the real cause, so that if he is overtaken by the same conditions, he may find a remedy.

This spring when I started, or rather tried to start, this pump, I found that one of the cylinders would not move nor could I bring sufficient power to move it. I took the cylinder heads off but could discover nothing that hindered it; no rust, no compression, and the lining of the cylinder appeared to be in good condition. Then I attempted to take

out the piston on the water end but could not stir it. Finally I noticed a check in the piston, and knew what was the matter, as the piston is of the wedge style. I had to break the piston to pieces with a cold chisel before I could start it. We put in a new one and the pump would run for a time very nicely, then it would short stroke and would sound as though it came in contact with a piece of metal, which is the way it worked the latter part of last summer. I took the cylinder head off again, and took out the piston and there laid a small piece of iron about 1" long, ½" wide, and ⅛" thick. As I had wiped the cylinder out with a piece of waste before putting in the new piston, I know that it was not in there at that time or else it was in some of the ports.

The only explanation I can give as to the pump running all right for a time, and then short stroking, is that when it was used in a vertical position the pump would take the full stroke. But when it laid in a horizontal position, the piston would strike agaist it. The piece of iron came from the back side of the cylinder, and the place from whence it came could be plainly felt with the hand. The piece of iron showed that it had been pounded for some time as the ends were battered down. If any one can, I wish they would explain how this piece of iron came to be broken from the end of the cylinder.

I put new packing in both of the pistons while I had it down, and when put back it worked very nicely for the first time, but when steamed up the second time the opposite left hand cylinder bound and would tremble the whole length of the stroke. I thought it did not have the proper amount of oil, although the lubricator seemed to be working all right. I examined the water cylinder again, and found the nut by means of which the packing in the piston is tightened, and which I had tightened up with my fingers the last time, was hard to loosen with a 12" wrench. I left it in the same condition as the first time and the pump worked all right, but repeated this swelling the next time. Any information regarding the swelling of this packing will be gratefully received.

Albany, N. Y. B. L. K.

Telephone Connections for Noisy Engine Rooms.

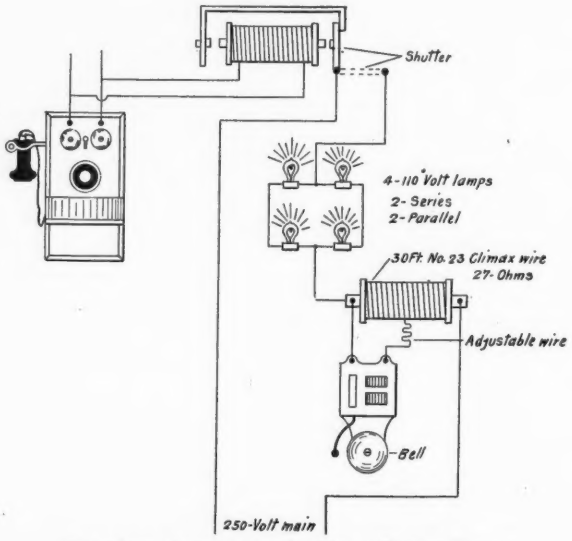
EDITOR THE PRACTICAL ENGINEER:

The following is the description of a device intended for power stations or any place where belts, pumps and other noisy apparatus exist and where an ordinary telephone does not make much impression.

A continuous ringing bell operated by drop and local battery is fairly good, but the cells which are soon exhausted are not always renewed at once. An ordinary bell will not last over thirty seconds, if used in series with incandescent lamps across 110 or 220 volts, as contacts are destroyed by excessive arcing.

I have four 110-volt lamps, two parallel, two series, in series with twenty-seven ohms of No. 23 Climax wire; about thirty feet of wire makes this resistance and is wound on a 2" x 2" x 18" piece of asbestos covered oak. These four lamps run very bright, due to high voltage, and yet they last a long while if phone is answered soon after it rings, and, of course, drop reset. I have the bell connected with one post to the wire between the lamps and resistance and the other post connected to a piece of wire which is moved along the resistance away from the first connection until bell shunts enough resistance to get current to ring. There is very little sparking as there are only a few volts pressure across the bell and the resistance passes the current while the bell contacts are open.

This combination has proved very satisfactory, as the lamp may be placed in the most conspicuous place and the bell where it is easily heard, and between the two, the phone is answered at once, and one does not have to wonder whether it rang or not.



Telephone Connections for Noisy Engine Room

If the bell is attached to the bottom of a tin basin, which is fastened by its rim to the wall, you can get plenty of noise. An ordinary telephone drop is thrown by a very weak calling current, and the night-bell attachment operates both lamps and bell. The shutter is attached to one side of the power lines, and the spring behind the shutter is attached to the wire running to lamps and resistance and thence to the other side of circuit.

It is a good idea if lamps are not handy to experiment with, to take dry cells and get a good strong ring which will give you an idea of how many lamps you require. Several bells may be operated from one shunt and as many lamps as you desire over and above the minimum needed to furnish the current for the bell, so that as bright a signal as is desired may be made.

Conneaut, Ohio. C. M. G.

Reason For the Difference in Results When Calculating Steam Consumption of Engine.

EDITOR THE PRACTICAL ENGINEER:

In answer to comments by J. W. of New Haven, Conn., which appear on page 26 of the August issue, I would say that in the first place the method of operation of finding the number of pounds of steam per horse power per hour is approximate only, and was characterized as "rough calculations" in my letter. The result so obtained, compared with that of J. W., is in excess about 6½ per cent., which is pretty

close for an approximation. In the second place, it is not quite true that when cut-off takes place at one-third stroke, there will be three expansions, and that the terminal pressure will be 35 pounds absolute as stated. The problem was simply operated from the "exhaust end of the cylinder," so to speak, while J. W. operates his problem from the "supply end." That J. W.'s application is more nearly correct goes without saying, but when considering the quantity of steam from the cylinder, knowing that losses occur between the entry and exit of the steam, the answer obtained by J. W. is probably as much out as that given by me in which no allowance for loss was made. Had the usual allowance been made, the net result would have been less than that shown by J. W., which would leave the matter somewhat more nearly correct.

It is to be expected that when operating such a problem from two different standpoints, where certain assumptions may or may not be made, and where certain known losses are not taken into account, that a difference in results is sure to be obtained. I repeat that the method adopted by J. W. is the better measure of steam consumption, while that applied by me is, as was originally stated, an approximation only, in which certain allowance for loss must be made.

With the foregoing explanation and reading between the lines in the original letter (Dec., '06, issue), I think it should now be clear why the difference between the answers exists.

Scranton, Pa. Chas. J. Mason.

Clearance and Condensation Enter Into Steam Consumption of Engine.

EDITOR THE PRACTICAL ENGINEER:

In regard to the letter of J. W. on page 26, August issue, I should think from the manner in which it was written that J. W. is one of those positive, I-am-right fellows, who regret their statements after they have pondered over them. J. W. says he has shown how much steam is supplied to the engine per hour, but his figures show merely the amount of steam per hour that a cylinder 15¼ in. x 8 in. will hold. I am sure J. W. has heard of cylinder condensation and actual clearance, and if he will take these into consideration he will find that the engine takes more steam than shown by his first figures.

Cambridge, Mass. T. A. R.

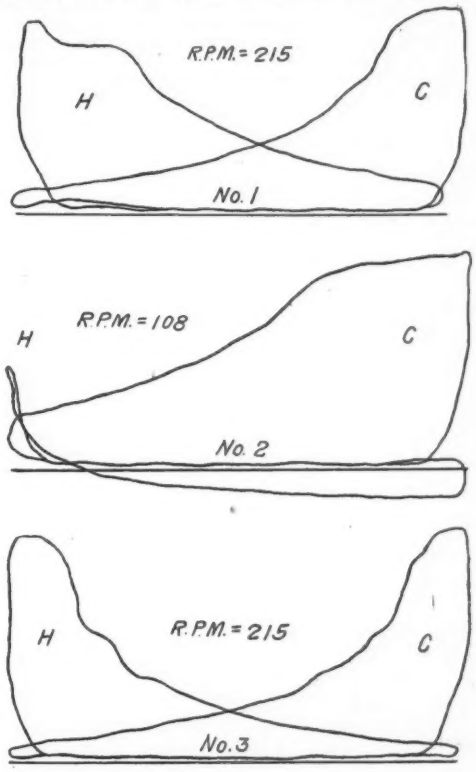
Indicator Cards Show Condition of Engine.

EDITOR THE PRACTICAL ENGINEER:

I submit herewith three indicator diagrams taken at different times from a 14 × 16 Buckeye engine of the riding cut-off, slide valve type. Card No. 1 was taken when the main valve was slapping on its seat at the head end. The sudden drop of the steam line and the rise of the back pressure line are the result of the valve leaving its seat for a small fraction of its stroke. It will be noticed that the valve reversed its motion seated, but that it flopped off and back again very suddenly, thus allowing the steam to blow through for a short time.

This trouble was caused by there being too much space between the balance plate and the griddle valve, resulting from the main valve and seat having been refitted quite often, the engine being an old one. Filling up the space with a sheet of copper removed the trouble.

Card No. 2 was taken from the same engine when the speed had dropped off to about one-half. The crank end shows good, but with a late cut-off, and that this end was carrying all the load. After taking this diagram, and locating the trouble, I found that the rods connecting the two cut-off valves were both broken, thus producing the diagram



Indicator Cards showing condition of Engine

as per head end of card No. 2. The cut-off valve stopped nearly square over the admission port of the main valve, allowing but very little steam to enter the cylinder, the piston creating a vacuum on its forward stroke, showing negative work.

Diagram No. 3, for the same engine, is not perfect by any means, but it gives a fair sample of what might be expected from an old engine of this speed running day and night.

Clinton, Iowa. L. A. H.

Speed Indicator Used to Indicate Receiver Pressure.

EDITOR THE PRACTICAL ENGINEER:

In reference to the speed indicator which W. A. D. describes in the April issue, I would say that we have one which works on the same principle, on a cross-compound steam engine, but we don't use it to tell the speed, but to regulate the receiver pressure. In paper mill work the load varies a great deal, so we regulate the cut-off on the low-pressure side and watch the pointer until the governor travels in the highest position for that load, and it's quite a help. I suppose some readers will say that this is the wrong way to regulate the receiver pressure and that we should equalize the load, but we are trying to save coal. T. S.

Adams, Mass.

QUESTIONS and ANSWERS

THE editor will be glad to receive from the readers of THE PRACTICAL ENGINEER, such questions relating to engineering subjects, as may, from time to time, occur to them. All questions and answers should be addressed to the editor and accompanied by the name and address of the writer, which will not be published, however, unless especially desired. It is the intention that questions shall be answered by the readers, and even though the editor may, from time to time, publish answers and questions, he especially desires the readers in such cases to contribute any further information, in connection with the points raised, that they may consider of interest. All questions and answers received by the editor will be published, as far as practicable, but he reserves the right of editing or rejecting any communication.

Sizes of Tap Drills for Different Size Pipe and Different Size Machine Threads.

EDITOR THE PRACTICAL ENGINEER:

As I am a reader of your always-looked-for paper, I would like to ask a favor, and at the same time say that it is certainly a friend to every engineer. I always wait anxiously for the next issue. What I wish to know is: Could you give a table of different size drills for different size pipe; that is, suppose we want to drill a hole for a ½-inch pipe, what size drill would it take? Of course, everyone can figure this out, but if a table is at hand it saves much time. I know there are such tables but have been unable to get hold of same. Also what are the sizes of drills for machine taps?

Minneapolis, Minn. H. C. T.

The sizes of tap drills for different sizes of pipe are as follows:

Diam. of Pipe.	Tap Drill.
¼	15/32
⅜	19/32
½	¾
¾	1
1	1¼
1¼	1 17/32
1½	1 13/16
2	2¼
2½	2¾

The sizes of tap drills for different size screws are as follows:

Diam. of Thread.	Size of Tap Drill.
¼	3/16
5/16	¼
⅜	9/32
7/16	11/32
½	13/32
9/16	7/16
⅝	½
11/16	9/16
¾	⅝
13/16	21/32
⅞	23/32
15/16	¾
1	27/32
1⅛	15/16
1¼	1 1/16
1⅜	1 5/32
1½	1 9/32
1⅝	1⅜
1¾	1½
1⅞	1⅝
2	1 23/32
2¼	1 31/32
2½	2 3/16

If, for any reason, a very tight thread is wanted, the size smaller tap drill may be used, but the hole must be reamed before the tap can be started.

Pumping Water.

EDITOR THE PRACTICAL ENGINEER:

I am digging a well 15 feet deep, and after sinking the suction pipe I would like to seal all around it with concrete. Kindly let me know if this will work, or will I have to allow an opening for the air to get in? G. R. B.

Georgetown, Can.

It would be impossible to draw the water 15 feet, or, in fact, any appreciable distance, if the atmosphere is not allowed to strike the surface of the water. If you are going to seal the pipe as you suggest, then it will be impossible to pump the water unless there is some air leakage, because it is the atmosphere which forces the water up. All that the pump does is to relieve the column of water from the atmosphere, since it is well known that water can only be in the state of compression and not in the state of tension.

Setting Safety Valves.

EDITOR THE PRACTICAL ENGINEER:

Will you please tell me how safety valves are set so that they will blow off at the correct pressure?

Chicago, Ill. M. A. B.

There are two kinds of safety valves in general use, the spring safety valve and the weight safety valve. When a weight is used, it is generally hung upon a lever so that its effective downward force can be regulated by moving the weight in or out from the fulcrum of the lever. When a spring is used, its tension is applied directly above the valve, adjustments being made by increasing or decreasing the compression of the spring. In setting a safety valve, the weight is hung at such a distance upon the lever arm, or the spring is adjusted to such a tension as to hold the valve upon its seat with enough force to balance the pressure of the steam within the boiler, but any increase in this pressure will lift the valve and allow the escape of steam to relieve the excess pressure The exact position of the weight or the exact tension of the spring must be found by experiment.

Current in Three-Phase Circuit.

EDITOR THE PRACTICAL ENGINEER:

As I have a three-phase, 50 horse-power, 500-volt motor to connect, will you kindly tell me how much current goes through each of the three wires when the motor is running fully loaded with a power factor of .9 and an efficiency of 80 per cent.?

Louisville, Ky. E.M.D.

The formula for finding the current passing through each wire of the three-phase circuit supplying the motor is as follows:

$$C = \frac{746 \times \text{Horse-power}}{\sqrt{3} \times \text{efficiency} \times \text{power-factor} \times \text{voltage}}$$

Substituting the given values, the formula becomes:

$$C = \frac{746 \times 50}{\sqrt{3} \times 0.8 \times 0.9 \times 500}$$

$$= 59.8 \text{ amperes.}$$

"Clean-Seat" Valves.

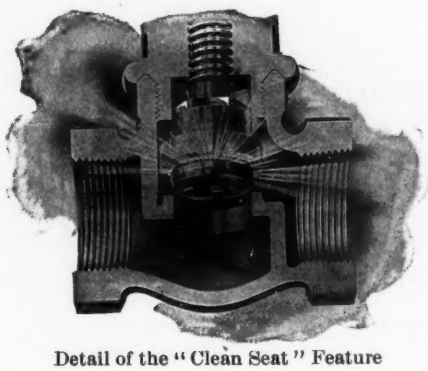
It is very important, when closing a valve, that the seat shall be free from sediment or other foreign matter, because if the disc is jammed down on the seat, when there is any obstacle between them, it will injure the surfaces which fit together, and hence prevent the valve closing tight.

A valve which has been designed to prevent the seat from becoming ruined in this way is known as the "Clean-Seat" valve, shown in the accompanying illustrations. The "clean-seat" function is performed by a jet of steam, water, air or other fluid which blows directly across the seat when the valve is being closed, thus carrying off any sediment or

Sectional and Exterior View of a "Clean Seat" Valve

foreign matter which would prevent tight closing, and possibly ruin the seat or disc.

Its construction and operation are as follows: A hollow cylindrical extension beneath the disc fits loosely in the seat and opens as the valve is closed. Lugs on the inside of this extension afford support where the cylindrical wall is cut entirely through all around by a slot below the disc face. In closing the valve, the main flow is throttled when



Detail of the "Clean Seat" Feature

the disc extension enters the seat opening, but a jet continues to flow through the slot and across the valve seat and the disc face until the final closure is complete. The cleaning jet cannot cause cutting action, as the steam is thrown directly across the meeting surfaces and not against them.

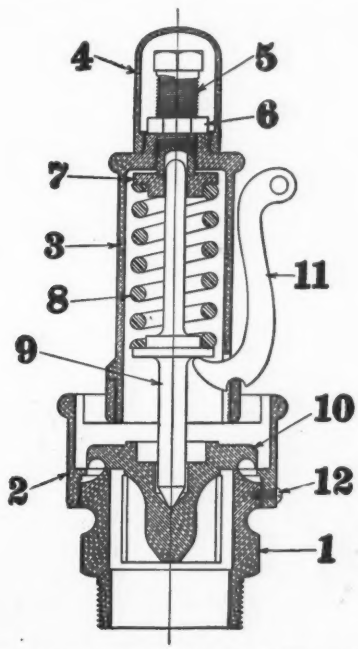
The stem may be packed with the valve open, as the top of the valve is faced to seat against the bottom of the bonnet. The bonnet is made with a long thread entering the valve body which, it is claimed, insures a tight and strong fit.

These valves are made of brass, in globe and angle pattern, for medium, extra heavy and hydraulic requirements by the Pittsburgh Gage and Supply Company, of Pittsburgh, Pa., who also use the same principle of construction for their blow-off valves for boilers.

The American Portable Pop Safety Valve.

Realizing the demand for a safety valve which has few parts and which at the same time is accurate, durable and positive in action, the American Steam Gauge and Valve Manufacturing Company, 208 Camden street, Boston, Mass., have placed the American Portable Pop Safety Valve upon the market to meet these requirements.

As shown in the accompanying illustration, it is capable of being adjusted and cleaned when necessary. The valve has a cap (4) at the top, which protects the compression screw (5) and adds to the appearance of the valve. When required, a lock-up attachment is furnished which prevents



The American Portable Pop Safety Valve

tempering with the blow-off pressure. The blow-off pressure is adjusted by removing the cap (4) at the top of the valve, the blow-down having a milled ring which is in the centre (2) of the valve. The centre (2) may be screwed up or down on the base (1) of the valve, by means of which the blow-down may either be increased or decreased, the blow-down being the number of pounds difference between the popping and closing points.

The valve is so constructed that it can be taken apart if scale from the boiler becomes lodged under the valve proper (10). This is accomplished by loosening locking screw (12) and disconnecting centre (2) from valve bottom (1)

and the valve (10). The valve (10) is fitted with wings which coincide with the reamed hole in valve bottom (1), and at the popping point lifts vertically. By removing the valve (10) from the valve bottom (1) the seat can be cleared of scale and re-ground. Access to the spring may be had by disconnecting valve top (3) from valve centre (2).

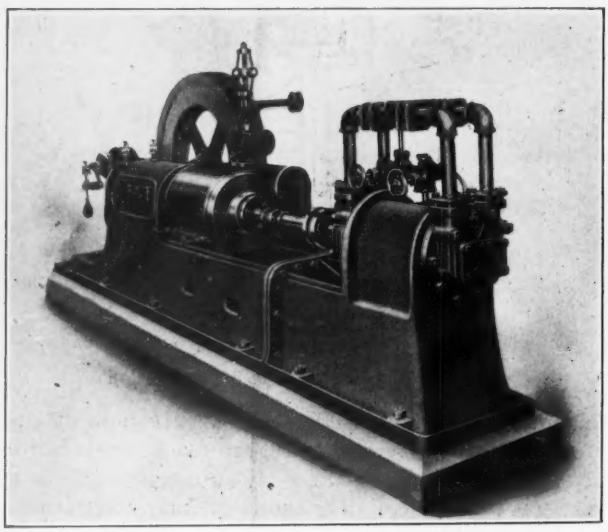
These valves are made of high grade steam metal, and are tested, adjusted and inspected by the manufacturers.

Empire State Refrigerating Machine.

The use of refrigeration has grown so very rapidly, particularly in hotels, dye works, fishing vessels, apartment houses, bottling establishments, confectionaries, breweries, hospitals, fur storage and drinking-water plants, that there is a demand for a refrigerating machine which combines durability, simplicity and economy in the smaller sizes, such as are generally used for the purposes above mentioned.

The accompanying illustration represents a horizontal, double-acting, steam-driven compressor which is built by the Empire State Engineering Company, 149 Broadway, New York, to answer such purposes. The bed plate is of the Tangeye type, the compressor being a separate casting with flanged joints. The fly-wheel end of the crank-shaft is carried on an adjustable outboard bearing, and the fly-wheel is carried between the main bearing and this support.

The steam cylinder runs tandem with the compressor, the piston rod being in two parts, connected by a turn-buckle. The compressor cylinder with separate sleeve can be replaced if necessary. The compressor valve cages are constructed and inserted in the head of the compressor in such a manner that in event of breakage the valve cannot enter the compressor. An air cushion effect is used instead



Empire State Refrigerating Machine

of buffer springs, so that the suction and discharge valves run practically noiseless. The valves can be removed without removing the compressor heads.

The steam valves are of the piston type. They are fitted with expansion rings and are driven by separate eccentrics. The valve motion has an adjustable cut-off to suit any given condition, the speed of the compressor being governed by a centrifugal throttling governor. The connecting rod is a solid forging and the cross-head is of the box type, with adjustable shoes.

These machines are made in various sizes and can be either belt-driven or direct-driven, as required.

The Royal Ventilator.

Among the systems of ventilation used for ventilating the factory, engine and boiler rooms, etc., that of using a ventilator on the top of the building commends itself on account of its efficiency and simplicity. In order, however, for a ventilator

The Royal Ventilator

to perform its most efficient service it should be so constructed that the impure or heated air shall always be free to escape into the atmosphere and at the same time it should deflect the downward currents of air and rain without interfering with its ventilating functions.

The Royal Ventilator, a cut of which is shown herewith, is built to fulfill these conditions. It consists of two cones, the upper cone being larger than the lower cone so that any rain or snow falling thereon is deflected outside the neck of the ventilator. The lower cone deflects the upward current of air and discharges it in thin sheets into the atmosphere. An upward draught is obtained by the use of the outside frustrum or deflector, so that whichever way the wind may blow, an exhaust current of air is induced from the building. Radiating ribs are used in the cones of the larger ventilators, which add to the rigid construction and increases its ventilating capacity. Edgewise braces are used to hold the different parts of the ventilator together and they are so arranged that the outlet of air is not obstructed. These ventilators have had an exceptionally large use on office buildings, mills, factories, hospitals, schools, churches and power houses throughout this country.

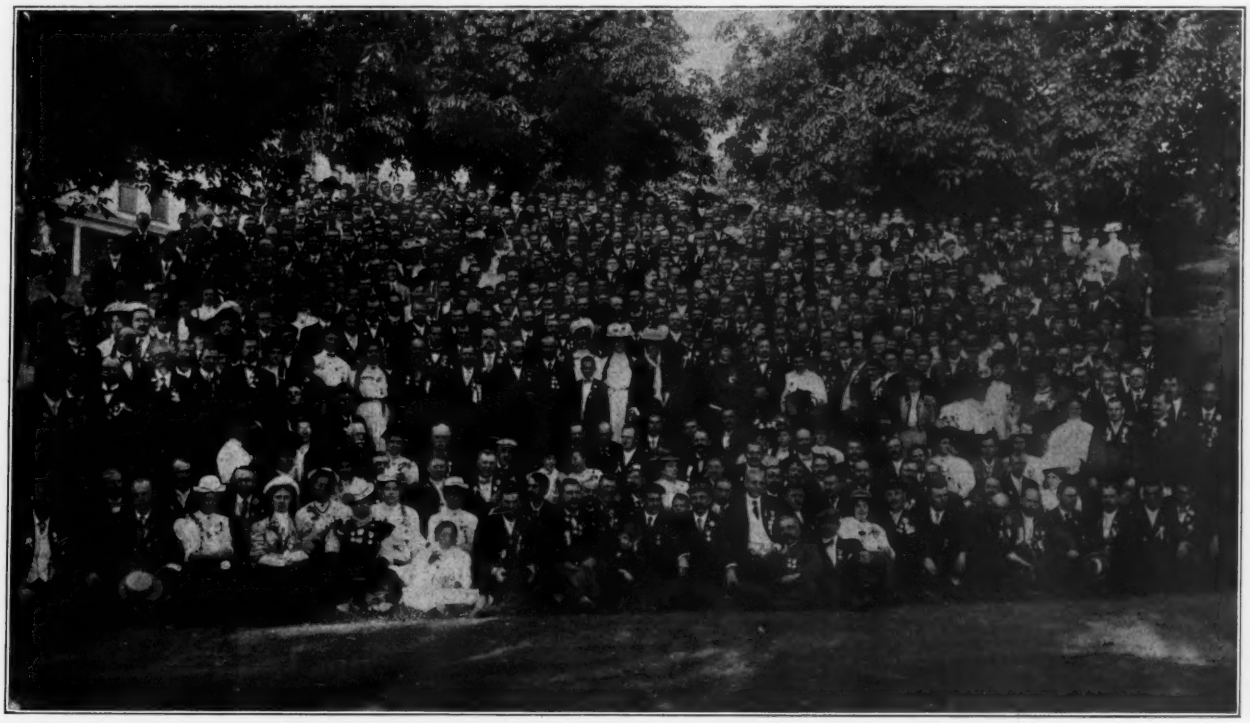
The Royal Ventilator and Manufacturing Co., 415 Locust Street, Philadelphia, Pa.

West Virginia N. A. S. E. Convention.

The annual State convention of the West Virginia State Association of the N. A. S. E. was held at Clarksburg, W. Va., on August 27-30. The meetings were held in the assembly hall of the Waldo Hotel. President J. L. Tracy called the convention to order and made a brief introductory address. He was followed by Mayor C. L. Crile, who extended the welcome of the city to the visiting delegates. W. W. Price responded on behalf of the association. The convention continued for three days and terminated with a fine banquet and speechfest in the dining hall of the Waldo. About eighty members were in attendance, besides numerous guests and supply men.

The Twenty-Sixth Annual Convention of the N. A. S. E.

"A convention that broadened the girth" was the slogan of one of the speakers that addressed the twenty-sixth annual convention of the National Association of Steam Engineers, held in Niagara Falls from September 9th to September 14th, and all the delegates agreed, after five days of fun and deliberation, that it aptly applied to this twenty-sixth meeting of engineers, supply men and visitors from various parts of the country. It was a convention whose dimensions were increased in four directions—in numbers, in fine exhibits, in pleasure and in sociability. There were several days devoted to soild fun, the exhibition of engineering supplies and equipment were as fine a collection as were ever gathered together, the social feature was well looked after in receptions and dances, and the number of persons attending probably exceeded that of any other convention.



Delegates and Visitors to the 26th Annual Convention held in Niagara Falls, N. Y. Sept. 9 h-14th.

The convention was formally opened on Tuesday, September 10th, in the auditorium of the National Food Company Building, at 10.45 A. M. Mr. Charles A. Baker, chairman of the Convention Committee, presided, and after welcoming the delegates, introduced Rev. A. S. Bacon, who delivered an appropriate opening prayer. In behalf of the Mayor of Niagara, Councilman Charles E. Cromley, in a flood of language presented the keys of the city to the delegates and wished them a hearty welcome. President T. N. Kelsey in his response laid stress on the educational feature of the organization and accepted the welcome on behalf of the visiting engineers. Congressman Peter A. Porter then spoke of the history of Niagara, and by a brilliant recital of the history of the world carried the origin of the Falls back long before the origin of man on this earth. He spoke of the length of time that they have existed and the many persons who have had the pleasure of viewing their beauty. Vice-President Joseph F. Carney responded by saying that he regretted that he did not have the eloquence to picture the history of the N. A. S. E. as the Hon. Peter A. Porter had pictured the history of Niagara, but he said that it did have a fine history and that he hoped it would soon hold in the general esteem of the engineering world the same position as the American Society of Mechanical Engineers.

Mr. John L. Harper, superintendent of the Niagara Falls Power Company, spoke of the development of Niagara. He said that about the year 1725 the Falls were first used for sawing lumber, which continued in a small way until 1825, when the more important hydraulic development started. It was not until 1881, however, that the first electric power was obtained from the Falls, a head of water of 86 feet being used, and it was not until August 26, 1895, that the first power was delivered commercially from the Falls, the power being used by the Pittsburg Reduction Company in the reduction of aluminum ore. Mr. Harper then described briefly the construction of the three large electric plants that obtain their power from Niagara. The Niagara Falls Power Company's plant, which is situated on the American side above the Falls, at the present time is equipped with 10-5000 horse-power units and 11-5500 horse-power units, making a total of 110,000 horse-power. The Canadian Niagara Power Company, situated on the Canadian side, contains 5-10,000 horse-power units and the

Ontario Power Company utilizes 60,000 horse-power, making a total of about 220,000 horse-power which is being used at the present time from the Falls, although the plants are built for an ultimate capacity of 350,000 horse-power.

In response to Mr. Harper, Mr. John Lane said that, despite the value of hydraulic power, the steam engine was never more in evidence than it is to-day, and notwithstanding the statements of the public press, which have long ago relegated the steam engine to the scrap-heap, the steam engine is with us to stay. After a short talk by the Rev. A. S. Bacon, whose witty sayings took the convention by storm, the convention was turned over to President Kelsey, who, after appointing the various committees, declared the convention adjourned until 2 P. M., at the Cataract House, where all the business meetings were held.

The business session on Tuesday afternoon was devoted to the report of committees, the Credential Committee reporting 368 delegates as having been registered. A stir was created when Charles H. Garlick took the floor as a matter of personal privilege. After a long statement he resigned as a member of the Board of Trustees of the national organ of the association, owing to trouble which arose on account of his having accepted commissions on business which he secured for the paper, the resignation being accepted by the convention. The License Law Committee reported that very little progress had been made during the past year in obtaining license legislation, the States of Maine, New Jersey and Massachusetts being the only ones in which anything has been accomplished. The convention then adjourned until 9 A. M., Thursday morning. In the evening an informal dance was held at the Cataract House in which an unusually large number of ladies participated.

Wednesday, September 11th, was devoted to a trip to Toronto. After a beautiful ride down the gorge of the Niagara the delegates and visitors embarked on the triple-decked steamer Chippewa, at Lewiston, for a ride across Lake Ontario to Toronto. Two bands of music made things lively, and luncheon and refreshments were served freely. On arrivng at Toronto everybody enjoyed the beauties of the city until 2.30 P. M., when the delegates met at city hall and had their pictures taken. A civic reception was tendered the delegates by Mayor Coatsworth and Alderman J. J. Graham, who presented the freedom of the city to the visitors, after being introduced by A. M. Wickens, chairman of the Reception Committee of the Canadian engineers. After the civic authorities had offered everybody a warm welcome, President Kelsey responded appreciatingly on behalf of his organization. The delegates were then given a two hours' trolley ride in twenty private cars, and the well-kept city of Toronto, with its university, public buildings, boulevards and parks, was universally admired. When the boat pulled out of the wharf at Toronto at 5.30 P. M. there were many loud cheers given by the N. A. S. E. for their most cordial welcome by the Canadian Association of Steam Engineers. On the return trip a repast was served, and the two bands were kept busy playing many familiar songs, in which many of the delegates joined. A feature which was not on the program was the storm through which the boat passed while on its return, and there were many persons, especially the ladies, who were troubled with the "mal-de-mer" and who had to make hurried trips to the side of the boat. Chewing-gum, peppermint and smelling salts were in great demand for a short time. The trip back through the gorge was made by searchlight, and the rapids being illuminated with colored lights, made the last end of the trip as enjoyable as the first, and everybody voted it to have been one of the most pleasurable trips that they had ever taken.

Members of the National Exhibitors' Association in Front of the Exhibition Hall, Niagara Falls, N. Y.

Thursday morning and afternoon was devoted to the business of the convention. The reports of the various committees were read and the awards of the prizes to the different associations for their educational work were made. In the evening a theatre party was given at the International Theatre, which was much enjoyed, particularly the moving pictures taken in Colorado, the latter being shown by the Denver contingent, who promised everything from trips up above the clouds to the taking care of the children, if only the delegates would decide to take the convention there next year.

The business of Friday morning principally centred itself about the selecting of the next place to hold the convention. Invitations were received from Albany, Seattle, Denver, Peoria, Kansas City, and Niagara Falls, but Denver, Col., won the honor by a large majority of the votes. In the afternoon the election of officers for the ensuing year was held, which resulted as follows: President, Joseph F. Carney, of New York City; Vice-President, Fred J. Fischer, of Los Angeles, Cal.; Secretary, Fred W. Raven, of Chicago, Ill.; Treasurer, Samuel B. Forse, of Pittsburg, Pa.; Conductor, William J. Reynolds, of Hoboken, N. J.; Doorkeeper, William T. Mead, of Indianapolis, Ind.; Trustee for unexpired term of three years, John A. Kerley, of Cincinnati, Ohio; Trustee for five years, Edward J. Lee, of Albany, N. Y.

On Friday evening the annual grand ball was held at the Cataract House. The ladies, who have come to look upon this function as the crowning social feature of the convention, were present in large numbers. There were many fashionable gowns worn and many engineers danced the light fantastic, which showed that the beauty and chivalry were present and that they enjoyed the expiring moments of the convention as well as the first.

THE LADIES.

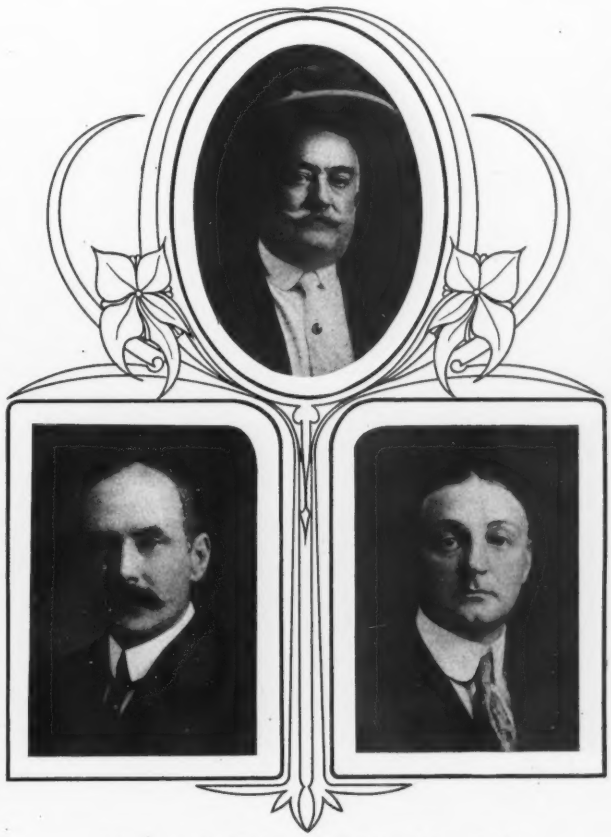
Throughout the whole convention the ladies seemed to have as much, if not more, fun than the men. They were ever present in the exhibit hall, and many of them were the recipients of many useful souvenirs which the supply men were giving out. On Tuesday, while the men were attending the afternoon session of the convention, the Ladies' Auxiliary held a meeting, and in the evening they attended the informal dance given at the Cataract House. On Wednesday they accompanied the men on the trip to Toronto and back. On Thursday there was a meeting of the Ladies' Auxiliary in the morning; in the afternoon they were taken on an automobile ride around Niagara, and in the evening they attended the vaudeville entertainment at the International Theatre. On Friday morning the final session of the Ladies' Auxiliary was held; in the afternoon they visted the Niagara Falls Museum, and in the evening they attended the ball at the Cataract House.

THE NATIONAL EXHIBITORS' ASSOCIATION.

The exhibition of engineering supplies and equipment, held in connection with the N. A. S. E. Convention under the auspices of the National Exhibitors' Association, was one of the best that has ever been presented to the engineers for their consideration and study. The exhibit was held on the third floor of the National Food Company's building and comprised about 130 separate booths, each of which was nicely decorated and fitted up with a full line of engineering supplies and equipment.

Owing, however, to the location of the exhibit hall, which was about one-half a mile from the convention headquarters, many of the delegates did not give the exhibition the attention it deserved, but, nevertheless, there never was such a large representation of untiring and courteous supply men, who were ready at all times to explain what they had on exhibition.

The exhibit hall was formally opened on Tuesday afternoon by John A. Carson, of A. W. Chesterton Company. He was formally introduced by Joseph F. Carney, vice-president of the N. A. S. E., in which he said that the display of engineering supplies at this convention was a vast education and demanded the attention of every engineer present. He said that the display no longer should be called exhibition, but exposition was a more fitting name to use. Mr. Carson in reply said that he was pleased that the exhibition had proven such a signal success and that the National Exhibitors' Association was ever ready to do its best along exposition and entertaining lines.



Officers of the National Exhibitors' Association
John L. McGilvray, President
Wm. D. Purcell, Secretary **C. K. Thomas, Vice-President**

On Thursday evening the National Exhibitors' Association met in business session at the Cataract House. The election of officers for the year 1907-1908 resulted as follows: President, John L. McGilvray, of the Peerless Rubber Company; Vice-President, Charles K. Thomas, of the

D. T. Williams Valve Company; Treasurer, G. D. B. Van Tassel, Westinghouse Machine Company; Secretary, William D. Purcell, of the Quaker City Rubber Company; Executive Committee: John H. Foote, of the McLeod-Henry Company; Edward McCarthy, of the George W. Lord Company, and William Schmidt, of the Lunkenheimer Company.

Among the other business that was transacted was the passing of a motion allowing the Interstate Exhibitors' Association to become subsidiary to the National Exhibitors' Association, so that more uniformity in the method of making exhibits at the different State conventions could be had. A motion was passed to make arrangements whereby a more uniform scheme of decoration would be possible, thus preventing the exhibitors from being held up and from being charged exorbitant rates by the local carpenters and decorators. A motion was also passed whereby steps will be taken at future conventions so that the public and local engineers will be invited to attend the exhibits. A committee of three, consisting of Mr. Shaw, Mr. Stone and Mr. Martin, were appointed to consult with the officers of the N. A. S. E., so that in the future arrangements could be made so that the convention hall and exhibit hall would be under the same roof.

Mr. John A. Carson, the retiring president, was then presented with a very fine gold watch and gold chain by the members of the National Exhibitors in token of their esteem for him and as a reward of the year of hard work which he had in connection with the exhibition. Mr. Herbert Stone made the presentation speech, praising Mr. Carson in his untiring efforts in behalf of the N. E. A. In reply, Mr. Carson said that he was glad that his efforts had been appreciated and that he would work for the N. E. A. as zealously in the future as he has done in the past. Mr. John L. McGilvray then took the chair and declared the meeting adjourned after having proven his capabilities as a presiding officer. Later that same evening Mrs. John A. Carson, the popular wife of the retiring president, was presented with a large cut-glass vase and a beautiful mother-of-pearl and gold-handle umbrella in token of the esteem of the National Exhibitors' Association, as they realized that she should have some reward for the many lonely evenings which she must have spent while "Jack" was away attending to the N. E. A. business. Mrs. Carson blushingly thanked the members for their very great kindness.

On Thursday evening, an event which was not on the program, but which created considerable amusement, was the meeting of the "Inch and a Half Club," which is composed of engineers and supply men. At this meeting several supply men were initiated with all the rights and ceremonies of this ancient and mystic engineers' organization. About two hundred persons were present, and several hours were pleasantly spent in listening to songs, jokes and music furnished by its members.

NOTES OF THE EXHIBITS

The Hohman & Maurer Manufacturing Co., of Rochester, N. Y., had an exhibit which attracted considerable attention. Thermometers to stand high temperatures and working models, electrically operated, of their Hot-water and Damper Regulators were shown. The arrangements and decorations of the booth were very pleasing. In charge were Mr. J. J. Kimmel and Mr. Donald Stuart.

The Northern Specialty Co., Utica, N. Y., had a very interesting display of their specialties, which include their Self-closing Safety Water Gauge. The engineers who investigated this device expressed great satisfaction. It is claimed that with the use of this gauge it is impossible to have a false water level, and that, in case of breakage of the glass there is no danger from flying glass. The exhibit was in charge of Mr. W. L. Pitts, general manager for the company, assisted by Mr. Franklin Pitts.

McCord & Co., Chicago, called attention to their exhibit with a beautiful floral display. The McCord Force Feed Lubricator was shown in full operation, driven by a small motor. Engineers were furnished fresh-cut flowers from this booth. Messrs. Newson and Hunter were in charge.

The Ball & Wood Co. made a display of their High-Pressure Flange Joints. A section of piping showing the welded flange, a full explanation of which was given by Mr. G. H. Jewell.

The Austin Separator Co., and the Wright manufacturing Co., of Detroit, with Mr. H. H. Humphreys and Mr. William M. Chamberlin, Jr., in charge, had an exhibit which was exceptionally well patronized by the engineers. The Austin Steam and Oil Separator, the Wright Emergency Trap, the Victor Steam Trap and the Cyclone Exhaust Head were among the large line of specialties displayed. Souvenirs were liberally distributed to visitors.

Morgan & Wright Company were in place with their usual display of Mechanical Rubber Goods, which included the well-known White Seal Packing. The exhibit was in charge of Mr. Earl W. Merritt, assisted by Mr. Harry Gordon. A very handsome N. A. S. E. watch fob was given to each engineer as a souvenir.

The New York Belting and Packing Co., represented by Messrs. C. H. Wilhoft, W. R. Wood, R. E. Reis, Jr., and Irvin Struck, aided by the artistic arrangement and decoration of their exhibit, had no trouble in attracting the attention of all engineers to their full line of Packings and Supplies. White Indestructible Sheet and Cobb's Piston Rod Packing were certainly made prominent.

The United States Graphite Co., Saginaw, Mich. Engineers, stopping to admire the floral decorations of this exhibit were given a deck of playing cards as a souvenir, after which Mr. J. W. Cummings and Mr. Isaac Wood told them, in a very pleasing manner, of U. S. Graphite in its many forms as a lubricant.

"Every Engineer Knows
Eureka Packings
and the
Robertson-Thompson Indicator,
But Many Don't Know
FRANK J. BLOOMER.
He Wants to Know You."

This was the very unique and explanatory sign which adorned booth No. 49, where the James L. Robertson & Sons, Inc., of New York, made a pleasing display and distributed interesting view books of the Panama Canal and great Pennsylvania Tunnel.

The Jones Under-feed Stoker Co., of America, showed a stoker model which Mr. E. J. Checkley, assisted by Mr. George W. Cole, were kept busy explaining the merits of. Good cigars bearing the legend, "The only thing that smokes" were given away.

Morehead Manufacturing Co., of Detroit, were represented by Mr. George W. Cole, who took pains to give a detailed explanation of the Morehead Return Trap, of which a neat model was shown.

James G. Ryerson & Son, Chicago, exhibited a working model of their Internally Fired Boiler, with Morrison Corrugated Furnace. Messrs. J. G. Corbett and G. D. Bramston, representatives.

The Perfection Grate Co., of Springfield, Mass., had one of the most attractive exhibits of the convention. They had two spaces with artistic decorations, in which was erected a 66 in. x 72 in. Perfection Grate in operative condition and so arranged to show the various meshes used for burning the different grades of fuel. Very appropriate postal cards were given as souvenirs. Mr. F. F. Ridlon, general manager, was in charge, assisted by Mr. C. B. Campbell and Mr. M. G. Hibbard.

The Binghamton Boiler Compound Co., Binghamton, N. Y., were represented by Mr. F. J. Bloodgood, general sales manager. Delegates and visiting engineers of the convention are likely to always remember Mr. Bloodgood, all having received valuable souvenirs, among which were a leather bill fold and coin purse, and a novelty pocket tool, comprising a combination screw-driver, nail cleaner, reamer, letter opener, cigar cutter and key ring.

Quaker City Rubber Co., with a beautifully arranged and decorated booth, were well

represented by the following representatives: Mr. W. D. Purcell, the new secretary of the Exhibitors' Association; S. B. Johnson, H. H. Horner and H. Rittenhouse. Their display consisted of samples of their full line of mechanical rubber goods. To the lady guests of the convention a prize drawing gas given on a beautiful cut-glass service, and to each delegate or visiting active engineer, a drawing on a valuable gold watch.

Chicago Bailey Co., of Chicago, made themselves very popular, their exhibit being located in the smoking room. Mr. E. F. Gould and Mr. H. G. Robertson, representing the company, with plenty of good cigars and help yourself, never forgetting, however, to mention the full line they were displaying of "The Chief's Own" Metallic Frictionless and Self-Lubricating Packings.

Cling Surface Co., Buffalo, N. Y., had a machine with which they demonstrated the efficiency of a belt treated with cling surface and running slack in contrast with a similar untreated belt running tight. Messrs. W. D. Young and J. B. Faatz represented the company and distributed puzzle cards as souvenirs.

Adam Cook's Sons, makers of Albany Grease, with their usual elaborate and pleasing display, ably represented by Mr. S. C. Cook and Mr. G. E. Tanberg, who delighted the engineers by giving them a pencil and case and an Albany Grease cigar.

Garlock Packing Co. were there with a full representation as folows: L. E. Adams, George W. Adams, I. D. Lyons, Fred L. Fuller, A. Hodget and (small but not least) H. M. Mickey from Denver. Good display of Packings, cigar cutters for souvenirs. "Nuf sed."

Potter Separator Co. had on exhibition a model of their separator and their representative, Mr. George Durand, was kept very busy "making his claims."

The Ashton Valve Co., of Boston, Mass., had a most elaborate display of the varied staples and specialties manufactured by them, among which were their well-known Pop Safety Valves, Pressure and Vacuum Gauges, water and cylinder relief valves. The Ashton Dead Weight Tester attracted much attention. Mr. Columbus Dill, their well-known and venerable representative, was in charge of the exhibit, assisted by Mr. H. H. Ashton and Mr. Frank Corbett, the popular tenor singer.

The Hoppes Manufacturing Co., Springfield, Ohio. Messrs. Charles and J. J. Hoppes were present and expressed great satisfaction with the success they were meeting in displaying their goods at the convention. The exhibit consisted of a 100 H. P. Hoppes Feed Water Heater and Purifier of the cast-iron type; also the Hoppes Oil Eliminator, Steam Separator and Exhaust Head. Aluminum ash trays, which were miniature counterparts of the Hoppes Pit Proof Heater Pans, were the souvenirs given out.

Cleveland Rubber Works, Cleveland, Ohio, exhibit was in charge of Mr. W. E. Saunders, sales manager, who improved every opportunity to talk "Marco" in his own impressive and convincing manner, and the engineers who were fortunate enough to visit the booth will not forget the science of the "Wedge" as explained by Mr. Saunders and his associates, Messrs. H. F. Fryant, W. G. Colburn and J. G. Bretson. A good briar pipe was given away as a souvenir.

Ridgeway Dynamo and Engine Co., Ridgway, Pa., distributed to engineers an interesting booklet containing descriptions and ilustrations of some of the many plants where Ridgeway apparatus is in use. Parts of the Ridgeway engine were on exhibition, in charge of Mr. H. A. Otterson and Mr. E. G. Rimmer.

Lumen Bearing Co., Buffalo. Lumen Metal for Bearings. The exhibit consisted of a display of Lumen Metal in the shape of Bearings of all sizes, from the smallest electric motor bearing to large engine bearings. Mr. F. H. Warren and Mr. L. A. Kendall represented the company.

The Bird-Archer Co., New York, were a centre of attraction at their booth in the exhibit hall. Everybody received a Bird-Archer souvenir and every engineer learned something more about Bird-Archer Boiler Compound. Mr. Tom Oakes and Mr. James O. Westberg represented the company, and seemed to never be tired. Among their long list of souvenirs were a balance puzzle, the "Line One" puzzle, the Pot puzzle, a Flat-iron girl looking-glass, soap, books and buttons.

The Chapman Valve Co., of Indian Orchard, Mass., with a conspicuous position and display at the corners of the front and centre aisles, attracted much attention. On exhibition was a full line of Chapman Standard Valves and Specialties, also the Morris Blow-off Valve. The feature of the exhibit was a large 8-inch motor, operated by a Chapman High-pressure Gate Valve. Mr. Herbert E. Stone was in charge.

H. W. Johns-Manville Co., manufacturers of Mechanical Asbestos Materials, showed samples of their full line, also the Morris Metallic Packing and the well-known "Vanda" Sheet and Piston Rod Packing. The company had a large representation, as follows: H. N. Winner, A. A. Lyons, George Semple, E. R. Skinner, F. J. Dresser, H. William McKivley, A. W. Morris, G. W. Kendrick and E. H. Younglove.

Kent Lubricating Co., Waukesha, Wis. The artistic oddity of the decoration at this booth was a "sure" attraction. Everything was yellow and black, even to the little ensign stick-pins distributed as souvenirs. Mr. Ed. K. West and Mr. L. H. West represented the company.

Empire State Engineering Co., of New York City. The Leyland Automatic Lubricator was shown to advantage, and Mr. James L. Forsythe, who was in charge of the exhibit, expresed himself as greatly pleased with the manner in which the engineers interested themselves in the device.

The Detroit Lubricator Co., Detroit, Mich., had an exhibit well arranged and conducted by Mr. J. C. Wills. A full line of Detroit Lubricators were shown, and a stick-pin in the shape of a Lubricator was distributed among the guests.

International Acheson Graphite Co., Niagara Falls, N. Y. "Oildag," in which graphite remains at all times suspended in oil, and "Aquadag," in which graphite remains suspended in water, were among the special Lubricating Compounds exhibited. Mr. E. C. Speider was the representative.

The William Powell Co., of Cincinnati, Ohio. Many were the attractions of this exhibit. The White Star Valve, with its double disc, reversible and renewable; the Union Composition disc, valves, oilers, lubricators and injectors. Unique White Star pendants and enameled stick-pins were the souvenirs distributed. Mr. Charles E. McFarlan, vice-president of the company, had charge of the exhibit, assisted by Mr. W. J. Leonard.

The V. D. Anderson Co. had a very interesting and instructive display of traps, floats, etc. The Red Book of Engineering information was distributed among engineers by the representatives of the company, Messrs. L. H. Rumage and I. P. Lounsbury, J. H. Meyer and H. J. Meyer.

The Fairbanks Co. This well-known concern exhibited their full line of valves and specialties, including the Geipel Steam Trap and the Dart Union. Mr. L. B. Mann and Mr. H. Jeffrey were in charge.

International Correspondence School of Scranton, had space which was decorated "a la" I. C. S. Messrs. J. D. Jones and John D. Hurley were there with convincing arguments and inducements for all to enter the paths of learning.

Mayville Specialty Manufacturing Co., Mayville, Wis., represented by Mr. F. P. Bird, had a model of their Monarch Patented Arch for combustion chambers and fire-doors of return tubular boilers. The arches are portable, easily put in or removed. Mr. Bird was kept busy explaining the great advantages of the Monarch Arch system.

Sherwood Manufacturing Co., Buffalo, N. Y. The line exhibited consisted of Oil Pumps, Injectors, Grease Cups, Tube Cleaners and Blowers. The Hart Force Feed Mechanical Oil Pump was particularly prominent. Mr. J. B. Whiteford was in charge.

The Leavitt Machine Co., of Orange, Mass., had one of the most attractive exhibits in the hall. They occupied two spaces, well located near the entrance, and the decorations were of the best. Messrs. F. L. Smith, F. D. Miller and T. C. Cronan represented the company, and all the engineers had an opportunity to hear and see them give a demonstration of the Morse & Dexter Valve Reseating Machine. A very novel and useful souvenir in the form of a small patented wedge wrench was given to engineers.

Keystone Lubricating Co., of Philadelphia, were, as usual, "there with the goods." Engineer's caps, oxidized gun-metal match safes, and for the ladies, very handsome celluloid engagement tablets, were the souvenirs distributed. The Keystone booth was beautifully decorated and the exhibit consisted of samples of Keystone Grease in its eight different densities. The representatives of th company were Messrs. H. A. Buzby, secretary of the company; Charles A. Hopper, H. L. Carpenter and M. B. Urquhart, who was also a delegate to the convention from Denver. Mr. Urquhart was given the appropriate soubriquet, "The big Indian from Denver."

The Strong Carlisle and Hammond Co., Cleveland, Ohio, had on exhibition a full line of their specialties, which included the Squires Feed Water Controller, the Squires Reducing Valve, the Squires Pump Governor and the Squires Steam Traps. Much interest was shown by the engineers in the Squires goods. In charge of the exhibit were Messrs. W. P. Whelpley, L. P. Strong, A. B. Pinney, F. H. Evans and C. H. Camp. The Engineer's Hand-Book which was given away was greatly sought for and appreciated by the engineers.

The Lunkenheimer Co., Cincinnati, occupied two spaces, in which were the Lunkenheimer specialties attractively arranged. The following representatives of the company were on the spot: William Schmidt, Jr., A. W. Dodds, W.

B. Smith and A. Brown. The Lunkenheimer boys were ably assisted by Mrs. William Schmidt, Jr., a "by-law" representative, who was exceedingly assiduous to the self-imposed task of registering the engineers for the mailing list and distributing electric pocket flashlights as souvenirs.

Gibson Iron Works, Jersey City, showed working models of their Gibson Common Sense Dumping Grate and the Gibson Common Sense Everlasting Shaking Grates. The Common Sense Spiral Steam Blower was also exhibited. Mr. Ralph Conrad was in charge.

Home Rubber Co., Trenton, N. J. Messrs. A. R. Foley and J. G. Berrang were in charge of this display, which consisted of the well-known brands of mechanical rubber goods manufactured by the Home Co. The "N. B. O." (Never Blow Out) sheet packing was predominant. Postals in series and the notorious "Fly Pin" were distributed. The demand for fly pins was so great that Mr. Foley, who became known as the "fly man," was kept busy eluding the fly chasers.

Kieley & Muller, New York, showed their line of Valves, Regulators, Separators, Pump Governors and Traps. The display was interesting and attractive. Many of the boys missed Mr. Kieley, who was otherwise engaged and unable to be present. Mr. Boylston, Western manager, was in attendance.

The Cyclone Grate Bar Co., Buffalo, N. Y., exhibited the Cyclone Shaking and Dumping Grate, invented by Mr. Henry Truesdale, who talking his invention to those interested. A was at the convention himself and kept busy complete working model was shown. Other representatives of the company were: Messrs. A. H. Hatfield, president, and W. R. Kindree, secretary. A handsome watch fob was the souvenir given away.

Liberty Manufacturing Co., Pittsburg. This exhibition, in charge of Mr. George Noble, was well patronized. The Liberty Specialties were all shown: the Twin Strainer, the Oil Purifier, the Blow-off Valve and the Heavy Duty Turbine Cleaner. The feature of this exhibit was a Turbine Cleaner with pneumatic connection which illustrated its operation.

James McCrea & Co., Chicago, Ill. Mr. W. B. Skinner, vice-president and secretary of the company, was at the convention representing their line of pipe repairs, consisting of the Climax Steam Joint Clamp, the Emergency Pipe Clamp and the Model Flange Clamp. The engineers were very much interested in this exhibit. The display was attractively arranged and a paper weight in the form of a handsome bronze lizard was the souvenir distributed.

The American Steam Gauge and Valve Co., Boston, were represented by Mr. Charles H. Craig, Jr., and Mr. C. Mosher. The American Thompson Improved Indicator, with detent motion reducing wheel and electric attachment, was displayed at the booth, and was the only steam engine indicator exhibited in the hall. The other specialties were the revised Throttling Calorimeter, Recording Gauge Dead Weight Tester, Valves, etc. The V. P. Speed Counter, a new instrument on the market, was also shown.

Walworth Manufacturing Co., Boston, were represented by Messrs. W. P. F. Ayer and G. F. Elliott; showing the Genuine Stillson Wrench, the Neverstick Blow-off Cock, the "Walmanco High Pressure Flange Joint and the Walworth Pipe Disc, and a general line of tools and valves for the engineer. The Walworth Manufacturing Co. distributed to engineers a souvenir in the form of a 6-inch nickel-plated Stillson wrench for the purpose of calling attention to the Diamond Brand "Stillson" which appears on their wrenches of which they have been makers for over thirty years.

Henry Steam Flue Cleaner Co., Minneapolis, exhibited their Flue Blower by displaying a model boiler with blower adjusted. Mr. W. M. Sage was on hand to explain the workings of the apparatus.

Cyrus Borgner Co., of Philadelphia, Pa., manufacturers of fire-clay goods, had an attractive exhibit in charge of Mr. Carl A. Dickel. A full line of standard and special shapes for boiler furnace construction were shown; also one set of arches and piers. Samples of their "Electric" Brand of Fire Brick, which has grown immensely in popularity and various lengths of arch lentles, were shown. Their souvenirs consisted of pocket memorandum books and pen-wipers, both of which were eagerly sought. The exhibit, as a whole, was tastily arranged.

The Westinghouse Machine Co., of Pittsburg, Pa., displayed numerous illustrations of Westinghouse Gas Engines and Parsons Steam Turbines. The exhibit was in charge of Mr. George D. B. Van Tassel and Mr. John Nicholson.

Strong Machinery and Supply Co. showed Packings, Packing Tools and Specialties. Mr. Stewart R. Browne and L. E. Strong were on the job.

Carborundum Co. exhibited carborundum products, grinding wheels and sharpening stones. Frederick E. Gridley, George N. Allen and R. B. Fuller were in charge.

American Boiler Economy Co., of Philadelphia, occupied a corner booth to the left of the main entrance, where a complete Cope's Boiler Feed Regulator was exhibited. The booth was also handsomely decorated with flowers, flags and bunting. A. W. Jones was in charge and landed some orders, and sold one Monday morning before breakfast. Jones is the New England representative for the Cope's Regulators and he's all to the good.

Green, Tweed & Co. occupied the first booth immediately opposite to main entrance, where Palmetto Packing was shown to excellent advantage, and a courteous and lively bunch of demonstrators entertained the visiting delegates with a running fire of instruction as to the best way to use Palmetto and the conditions under which it produces the most helpful results. Sample boxes of Palmetto Packing and other souvenirs were freely distributed. Those in charge were Mr. H. S. Demarest, B. M. Bulkley and F. R. Ransley.

Westinghouse Air Brake Co. exhibited a portable electrically-driven air compressor plant, used around power plants for cleaning generators, driving boiler tube cleaners or for any other purpose where compressed air is required. They also exhibited a steam-driven air compressor for service where steam is available. W. H. Wright, S. H. Mills, M. H. Burchard, and C. D. Brown were there with a nice watch fob for each delegate.

Revere Rubber Co., of Boston, Mass., showed one of the finest packing exhibits in the hall, featuring their "Black Hawk" High Pressure Spiral and Sheet Packings, a variety of pump valves, hose rubber mattings and a complete line of mechanical rubber goods. The "Usudurian" guessing contest of the Revere Rubber Company was one of the unique features of the convention, the idea being to guess the weight of the scrap and the weight of the gaskets cut from one square yard of one-eighth inch "Usudurian" Packing. The gaskets were of standard sizes, and the gaskets and scrap were tacked to a board in their original condition after being cut out. The object of the contest was to demonstrate the amount of packing that is usually wasted in making gaskets of standard sizes. Every engineer realizes that forty-five to fifty per cent. of the packing is wasted in this way, and the Revere Rubber Company buys this unused plain "Usudurian" scrap at an exceptionally high price. The first lady's prize was awarded to Miss Ella Connor, St. Mary's, Pa., being a pair of Lamar pearl opera glasses. The second lady's prize was awarded to Mrs. A. W. Price, Philadelphia, being a silver and pearl-handled umbrella. The first gent's prize was awarded to W. T. Mead, delegate from Indianapolis, Ind., being a copper finish mission design coffee percolator. The second gent's prize was awarded to R. C. Taylor, Lorain, Ohio, being a complete safety razor shaving outfit. Those in charge were W. D. Rigdon, of Boston, and George C. Penboss, of the New York store.

The George W. Knowlton Rubber Co., of Boston, exhibited Hub Sheet Packing. Mr. Knowlton, dapper and smiling, greeted the delegates, among whom he is a well-known figure, and told them of the virtues of "Hub Sheet," which weighs but four and a half pounds to the square yard.

A. W. Chesterton & Co., had a handsome corner booth in the main hall, where they showed a splendid display of sheet and piston packing for every service, including Rubberbestos Sheet, Perfection Sheet and Vaporite Sheet, which latter is a new indurated and compressed sheet packing made expressly for high pressures and superheated steam; also for gas engines. Rubberbestos spiral packing, "Combination" rod packing and the other well-known Chesterton products all attracted a large share of attention. John Carson, the retiring president of the National Exhibitors' Association and a favorite with the delegates, and Mr. H. D. Raymond, who were in charge, were always surrounded with crowds of delegates.

Lead Lined Iron Pipe Co., of Wakefield, Mass., exhibited samples of lead-lined iron pipe and tin-lined iron pipe, the exhibit being in charge of P. J. Kelley.

Norwall Manufacturing Co., of Chicago, showed Air Valves, packless Radiator Valves and the Holland Flexible Pipe Joint. J. W. Rowe and James D. Hoffman were in charge and distributed souvenir paper cutters.

Charles A. G. Winther, of Boston, Mass., exhibited a fine line of Monarch Valves made by the Monarch Valve and Manufacturing Co., of Warren, Mass. The loose neck arrangement in these valves, which permits changing from left to right or vica versa, attracted marked attention for those present, and Mr. Winther's merry "chuckles" made him a favorite.

Allis-Chalmers Co. passed out tons of good engineering literature in pamphlet form. Spencer E. Hickman and R. D. Tomlinson were in charge.

France Packing Co., of Philadelphia, exhibited a fine display of the France sectional ring metallic packings, also France sheet pack-

ing and a complete line of fibrous piston packings, all of which were demonstrated by Mr. A. W. France and John K. Rutherford. A combination pen and pencil which they distributed proved to be a popular souvenir.

Pittsburg Gage and Supply Co., of Pittsburg, exhibited their new Clean Seat Valves, Pittsburg Pressure and Recording Gauges, Pittsburg Safety Water Columns, Separators and White Star Oil Filters, all of which were entertainingly demonstrated by Mr. A. K. Ashworth.

Dixon Crucible Co., of Jersey City, exhibited Dixon's Graphite products, including their well-known Graphite Grease, Graphite Brushes, and Silica Graphite Paint for smokestacks and boiler fronts. In charge of L. H. Snyder, John A. Condit and W. F. Swearer.

The Lagonda Manufacturing Co., of Springfield, Ohio, occupied a double-sized space, in which they exhibited all styles of their Weinland boiler tube cleaners, the Lagonda Automatic Boiler Cut-off Valve, the Lagonda Damper Regulator and other specialties made by the company. Those in charge were James H. Johnson, H. G. Weinland, M. M. Sellers, D. B. Hauer and H. F. Weiland.

Twentieth Century Frictionless Metallic Packing was exhibited by the Metallic Packing and Manufacturing Co., of Cleveland, Ohio. This packing is of the sectional ring type. It was ably demonstrated by Mr. A. B. Nichols, E. J. Lawler, T. C. Green and F. A. Jones.

The B. F. Goodrich Co. exhibited their line of Red Radium Packings, which are a combination of 25 per cent. rubber and 75 per cent. long fibre asbestos. H. W. Zeliff was demonstrator.

Hills-McCanna Co., of Chicago, showed the Hills-McCanna force-feed lubricating pump. Mr. Robert E. Hills was in charge and made many converts to the force-feed method of lubrication, for Mr. Hills is an expert on mechanical methods of lubrication, with many years of practical experience, and to talk with him is to be convinced.

Walch & Wyeth, of Chicago, showed the Erwood Straight-Way Swing Gate Valve and Manganesite Paste for pipe joints. Dr. Walch was in charge.

Standard Gauge Manufacturing Co., of Syracuse, exhibited Eclipse Oil Filters, Eclipse Exhaust Heads, a display of Pressure and Recording Gauges, Tachometers and Counters. James J. Mason was in charge.

The H. & M. Valve Co. exhibited Triple Duty Valves for boiler and pipe protection, in charge of Mr. J. A. Cartwright. The valves were all right.

Diamond Power Specialty Co. showed the Diamond Rear-End Flue Blower, which is a permanent fixture at the rear end of the boiler for blowing tubes. A. D. Harris and Mr. R. Herman were in charge.

H. B. Underwood & Co., 1025 Hamilton Street, Philadelphia, exhibited Cylinder Reboring Apparatus, Valve Facing Machines, St. John Packing, a Safety Noiseless Ammonia Valve, and their two-cylinder engine for driving boring bars and for all purposes where temporary or intermittent light power is required. H. D. Griffith and C. O. Ralph were in charge.

The Dearborn Drug and Chemical Works, of Chicago, were represented by C. M. Eddy, William B. McVicker, William Schaatz, Dan Delaney, J. W. Wilson, Frank Erdley, Joe Gregory and P. H. Hogan. The Dearborn booth was handsomely furnished and their many souvenirs were popular with the delegates.

Ox-Oil-Ox, the new belt dressing, was exhibited by F. S. Walton Co., of Philadelphia. P. F. Riley and J. A. McDevitt told the delegates about it and made many friends.

Rochester Force Feed Lubricators, which are manufactured by Green, Tweed & Co., of New York City, were demonstrated by Mr. W. J. McMahan, who knew his subject well and convinced many delegates that they need the "Rochester" in their business.

The Crandall Packing Co., of Palmyra, N. Y., displayed a complete line of fibrous rod and sheet packings and gave out quantities of souvenirs. B. M. Knoble, J. M. Chapman and Herbert Self were popular representatives.

The Buckeye Engine Co., of Salem, Ohio, had as usual the most popular booth of all. No Buckeye engines were shown, and no attempt was made to urge their points of superiority upon the visitor. You could see some handsome framed photographs and you could get a catalogue if you asked for it, otherwise you got a pleasant greeting from C. H. Weeks, president of the company; a fresh-cut flower in your buttonhole and a "Buckeye" or horse chestnut attached to a pretty silk ribbon as a souvenir.

A Self-Sealing Gasket was shown by E. A. Wilcox Manufacturing Co., of Chicago, with Mr. Wilcox in charge.

Watson & McDaniel Co., of Philadelphia, exhibited steam traps, reducing valves, pump governors, separators, exhaust heads and their full line of specialties, all of which made a handsome exhibit. Fred L. Jahn was there with the goods.

The Steel Mill Packing Co., of Detroit, was represented by Mr. George R. Beamer, manager of the company.

Trimont Manufacturing Co., of Boston, Mass., makers of the famous Trimont Wrench, were represented by Mr. F. E. Sands, a popular devil.

The Lake Erie Boiler Compound Co., of Buffalo, exhibited Red Star Boiler Compound, showing the various style and sized packages in which Red Star is delivered; also the Perfection Compound Feeder, used with great success in connection with Red Star compounds. A popular feature in connection with this exhibit was the serving of Red Star Boiler Compound Punch, a delicious and refreshing drink which was much sought after by the ladies. Those in charge were Mr. E. C. Schwengel, W. W. Horner and George J. Juhre. During the convention "Rodney Gumkirk" happened along, and he and Mr. Schwengel engaged in a discussion of the merits of boiler compound as a scale remover. "Rodney" declared that compounds were of no use, he having dumped a whole barrel of the "dinged stuff into his thrashin' biler at once; so he nowd what he was talkin' 'bout.'

Charles T. Luce Co., of Boston, exhibited the Kelley forced draft system, which is for use where natural draft is insufficient and as a smoke preventer. So popular was this device that Mr. Luce booked orders for nine while on the train going to the convention. Mr. Luce and Mr. Kelley were in charge of the exhibit. The Luce Co. also handle Mansfield Ball-Bearing Grates, Greenway Exhaust Heads, Separators and Traps, Robinson Standard Fusible boiler Plugs, Rear-end Flue Cleaners and numerous other specialties.

Michigan Lubricator Co., of Detroit, showed a line of lubricators, the newest feature of which was an automatic drain stem to prevent loss of oil in draining and refilling lubricators. Mr. W. E. Bryant was in charge.

The Buhne Metal Packing Co. exhibited Buhne "all metal" packing, in charge of Mr. T. M. Remington.

The D. T. Williams Valve Co. was represented by Mr. Charles K. Thomas, secretary of the National Exhibitors' Association, and without doubt the busiest man at the convention. Great credit is due Mr. Thomas for the able manner in which he handled the exhibits.

The Peerless Rubber Manufacturing Co., of New York, showed a handsome exhibit of Rainbow Sheet Packing, Peerless Piston Packing and Eclipse Gaskets. They also conducted a highly popular guessing contest for delegates and their wives, the prizes being an Indian motor cycle for the lucky delegate and a handsome Victor talking machine for the lucky lady. These were without doubt the most valuable prizes ever given away at an engineers' convention. The winners were Mrs. John McSpadden, Main St., Niagara Falls, and Mr. William J. McMahon, 515 Third Street, Niagara Falls. Those in charge were John Gilvray, the new president of the National Exhibitors' Association; C. S. Brasser, J. F. Kirsch, Dan Cubberly, P. G. Staunton and Mr. Stephen Roberts, manager of the Peerless Company's publicity department.

McLeod & Henry Co., of Troy, N. Y., who make the famous "Steel Mixture" boiler arches and fire-brick, had a popular exhibit, in charge of Mr. John H. Foote, manager of their New York office, and Mr. Edwin Henry.

The George W. Lord Co., of Philadelphia, makers of Lord's Water Purifying Chemicals, had a magnificently decorated booth covered with a mass of brilliant electric lights and handsomely furnished, in charge of Captain J. E. Doughty, Edward McCarthy, D. H. MacElroy and C. W. Phillips. Moving pictures were given as souvenirs.

Cancos Manufacturing Co., of Philadelphia, makers of popular Black Squadron Packing and other mechanical rubber goods, was represented by Mr. H. Harmstad.

Jenkins Bros. were well represented by Charles W. Martin, Jr., H. B. McLilland and Charles J. Jackson. Their booth was attractively decorated and their exhibit was handsomely arranged. It consisted of the well-known Jenkins Standard and Extra Heavy Valves, including their extra heavy gate valve, which received much attention; also Jenkins "96" sheet packing, gaskets, gasket tubing and Sellers injectors.

The Vanda Packings, manufactured by the Vanda Co., of New York, were shown in the booth of Johns-Manville Co.

The Detroit Leather Specialty Co. were represented by Mr. Charles A. G. Winther, their popular New England representative.

The Sims Co., of Erie, Pa., showed a full line of Sims products, including oil fillers, open and closed feed-water heaters, boiler compound feeders, etc., in charge of Mr. Henry Sims, president of the company, who is well known and popular with those who are regular followers of the convention.

TRADE NOTES

EDITED BY THE ADVERTISING MANAGER

ANNOUNCEMENT.

We regret to inform you that a very disastrous fire visited our new Hunt Street factory on the night of August 22d, and same was completely destroyed.

We had just moved our lubricating department into this building prior to the fire, and it is the only department to suffer—to the extent of tools and machinery; our patterns remaining intact at our Broadway plant.

We are now installing a new lubricating department at 410-412 East Eighth Street, which will be our temporary quarters until our old factory is rebuilt. Castings and tools are being made with all possible dispatch, and we are pleased to announce deliveries on lubricating devices about October 15th.

We are compelled to make a general announcement of the fire, owing to the fact that false reports have circulated among the trade regarding the extent of our losses and our ability to make deliveries. Quite to the contrary—

"We are still in the game and we want your business."

Yours respectfully,
THE D. T. WILLIAMS VALVE CO.
September 7th, 1907.

The Pittsburgh Gage and Supply Co., Pittsburgh, Pa., have installed White Star Continuous Oiling Systems in the engine rooms of the Fitchburg Yarn Co., Fitchburg, Mass.; Indianapolis and L. Traction Co., Scottsburg, Ind.; Berwind-White Coal Mining Co., Windber, Pa.; Tennessee Coal and Iron and R. R. Co., Ensley, Ala.; Seconnet Mills, Fall River, Mass.; American Sheet and Tin Plate Co., Vandergrift, Pa.; American Bottle Co., Newark, Ohio; Bethlehem Steel Co., South Bethlehem, Pa.; Diamond Rubber Co., Akron, Ohio. The great saving in lubricating oil, requiring but one handling by human means (from barrel to system), its constant use, being cleaned by the White Star Filter after passing through the bearings, and thence used over and over again until actually worn out, renders the use of an Oiling System an actual necessity in every up-to-date power plant. A new catalogue just issued is free to those interested. Address as above.

No matter where you live, you can find the name of a neighbor among the list of those who use "Steel Mixture." The list fills a large booklet, richly bound, and having a clever and convenient thumb index, which makes it easy to turn at once to any desired section. It is probably not intended for general distribution, but if you are interested in "Steel Mixture" Boiler Door arches or Fire Box blocks and mention THE PRACTICAL ENGINEER you can doubtless get a copy from McLeod & Henry Co., Troy, N. Y.

The Garlock Packing Co., 670 Howard Street, San Francisco, have their new four-story brick factory and store in full operation, and are now employing forty men. This is the largest rubber packing concern on the Pacific coast. They manufacture a full line of fibrous and sheet packings, belting, hose and engine-room supplies, and are also the largest metal packing manufacturers in the world. Their business has increased so rapidly during the past ninety days that a larger factory and floor space is now under active consideration. This company's handsome, 176-page, illustrated catalogue for the year 1907 has just been received. This book is complete and one of the finest they have ever published, and they wish to state that a copy will be mailed to any and every engineer interested in their line, as well as all other customers, and request them to make their headquarters with the company while in San Francisco.

The increased demand for Powell Steam Engineering Specialties makes an enlargement of the plant of the William Powell Co., Cincinnati, a necessity. Plans are being prepared to erect buildings on ground 37 x 200 feet recently acquired by them, and to increase their power plant by 200 horse-power.

Jenkins Bros., of 71 John Street, New York, manufacturers of valves and packing, have issued a catalogue fully illustrating and describing their different products. It is of convenient size, 128 pages, and contains over one hundred illustrations. Among the well-known specialties manufactured by Jenkins Bros. may be mentioned Jenkins '96 Packing, which is adapted to all joints around a steam plant, working equally well on steam chest covers, superheated steam joints and all high-pressure work; Jenkins Gasket Tubing for packing manholes; Jenkins Valve Stem Packing and the well-known Jenkins Bros. Valves. These are only a few of the specialties described in their catalogue, which will be sent free to anyone mentioning THE PRACTICAL ENGINEER.

John Acton, 118 John Street, Brooklyn, N. Y., has just issued a small catalogue of modern automatic steam, water, air and vacuum specialties. The meritorious features of these appliances are clearly explained in the catalogue, which will be sent to any engineer upon request.

The Keystone Chemical Manufacturing Co, Philadelphia, Pa., have published a very interesting and handsome catalogue on the subject of water softening and purification. It is an illustrated description of the Keystone Pressure Filter System and Mechanical Filtration, and describes in an interesting manner the causes of incrustation, corrosion and foaming of boilers, and the properties found in water that are detrimental to boilers. Every engineer should send for this catalogue, for it certainly is instructive as well as interesting reading.

The Tacony Iron Company, of Philadelphia, Pa., have just issued a catalogue which is a "beauty." It contains several fine illustrations and fully describes the merits of Tacony Turbine Pumps. It will prove very interesting reading to those interested in pumps and the Tacony Iron Company will be pleased to send a copy to anyone who sends their name and address.

The American Water Softener Co., of Philadelphia, Pa., announces that they have taken over the business of the Hungerford Filter Corportion and are now the sole manufacturers of the well-known Hungerford Water Filter.

Mr. George McQuilkin, Jr., chief engineer of power plants, South Works Illinois Steel Co., South Chicago, Ill., wishes catalogues and descriptive matter covering all kinds of power plant equipment and supplies.

Engineers send your address and who employed by, and we will send one set of Corliss Valve Rod Packing free of charge, Express Prepaid. Give diameter of rod, gland, and depth of box. Also state if bottom of box is *bevel or square.* Ideal Metallic Packing has no equal for steam, air and ammonia. We have the documents to prove it. Address, IDEAL METALLIC PACKING CO., South Stillwater, Minn.

Wanted Salesmen traveling among engineers to sell the France Metallic and Fibrous Packings. Good inducements on unoccupied territory, Address FRANCE PACKING Co., Tacony, Phila., Pa.

WANTED—Engineers and Mechanics to make big money selling O. K. Hand Soap. A 10-cent Can will instantly remove more dirt and stains from the hands than 4 cakes of any soap made, and it will not injure the most delicate skin. Small sample free. O. K. HAND SOAP CO., 570 Columbus Ave., Boston, Mass.

JUST OUT—PATENTED
THE STEAM ENGINEER'S SLIDE RULE

Gives Mean Effective Pressure of Steam or Air in one setting. F. F. NICKEL, 27 Winans, Street, East Orange, N. J.

100 Letter Heads, 100 Envelopes and 100 cards postpaid. Samples 2c. R. D. ELLIOTT, Dept. C., Box 1376, St. Louis, Mo.

A gilt edge proposition for a few travelling and erecting engineers. Address, Box 24, South Stillwater, Minn.

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WRITE TO-DAY
THEO. AUDEL & CO., Pub.
63 Fifth Ave. New York

Save Your Drip Oil

by putting it through a "Burt" Unit Oil Filter which will positively remove all the dirt and grit and save from 50 per cent. to 90 per cent. The "Unit" filters the oil first and then washes it with water, delivering it absolutely clean and pure at a rate of 200 to 250 gallons per 24 hours. Your dirty oil can be put through this process again and again, and each time the saving will be obtained. The Philadelphia Rapid Transit Company uses 26 (fifth order) Units.

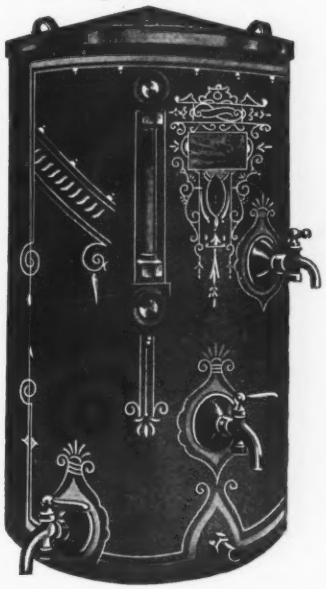
Have you our new 80-page catalog?

The Burt Manufacturing Co.

204 Main St., Akron, O., U. S. A.

Also supplied by Engine Builders, Dealers and Power Contractors. Agencies in nearly all the principal cities of the world.

Keep On Using Your Oil



The Cross Oil Filter thoroughly washes and cleans lubricating oil, removing all dirt and sediment and saving from 50 per cent. to 75 per cent. of the oil used. It is always ready for work and the cost of maintenance is only a few cents a year. There is nothing to clog or get out of order, and the "Cross" is guaranteed against defects.

Our new 80-page catalog FREE for the asking.

The Burt Manufacturing Co.

204 Main St., Akron, O., U. S. A.

Also supplied by Engine Builders, Dealers and Power Contractors. Agencies in nearly all the principal cities of the world.

For Clean Exhaust

The Burt Exhaust Head attached to the exhaust pipe is the most effective muffling device known and is unequalled for separating oil and moisture from the escaping steam. By using a "Burt" the walls and roof are kept dry and free from decay, and fuel is saved by the return of condensation to the boiler.

The Baldwin Locomotive Works uses 53 Burt Exhaust Heads.

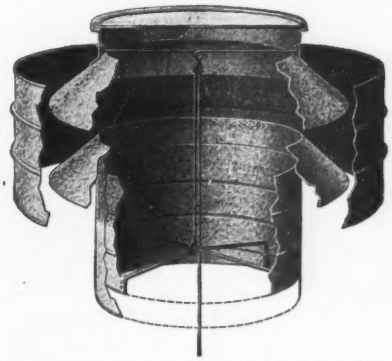
How about our 80-page catalog? Do you want one?

The Burt Manufacturing Co.

204 Main St., Akron, O., U. S. A.

Also supplied by Engine Builders, Dealers and Power Contractors. Agencies in nearly all the principal cities of the world.

For Perfect Ventilation



Sectional view showing glass top with sliding-sleeve damper (patented)

The Burt Ventilator keeps the air always clean and pure in the engine room. It has no back current of air, and it cannot become clogged with snow or ice or get out of order in any way. It can be had with glass top if desired, making a combined skylight and ventilator.

You ought to have a catalog of the Burt devices. Send us your name and address and we'll send you one at once. It contains 80 interesting pages. The Nordberg Mfg. Co., Milwaukee, recently ordered 48 - 30 & 48" Burts for use on their new foundry—one of the finest in the U. S. A.

The Burt Manufacturing Co.

204 Main St., Akron, O., U. S. A.

The care of belts and how to clean them, thus making them pliable so they will hug the pulley closer is discussed in a circular issued by Norbert Wolff Co., 472 Greenwich Street, New York.

The "De La Vergne" two-cycle vertical oil engine, which has just recently been placed on the market, is described in a folder issued by the makers. It is designed for the use of cheap oils, kerosene or fuel oil, not for gas or gasoline, and is made, as yet, only in two sizes, 7½ and 15 H. P. Other sizes are under way. A copy of the folder, giving full description, can be procured from De La Vergne Refrigerating Machine Co., foot of 138th Street, New York City.

The Cutler-Hammer Manufacturing Company (Milwaukee), makers of electric controlling devices, have just issued a booklet—pigeon-hole size—descriptive of their line of electric crane controllers. In addition to full descriptions and illustrations of five types of crane and hoist controllers, the booklet contains connection and dimension diagrams, repair part charts, prices, net weight and shipping weight of apparatus, etc. An improved form of contactor for handling heavy currents is also described.

The Riverside Engine Co., Oil City, Pa., builders of the Riverside Heavy Duty Gas Engine and Gas-Driven Air and Gas Compressors, are strengthening their sales department by establishing a number of sales agencies. Mr. L. B. Lent, M. E., formerly of the Wile Power Gas Co., will have charge of the New York office, at 26 Cortlandt Street. The Pittsburg office, at 710 Empire Bldg., will be in charge of Messrs. N. C. Davison Co. The W. E. Austin Co., with headquarters in the Candler Bldg., Atlanta, Ga., are looking after this line in the Southern States. Arrangements will shortly be made for sales agencies covering the Western territory.

The Templeton Manufacturing Co., 22 Randolph Street, Chicago, want to send their catalogue to any of our readers who are thinking of purchasing steam traps. The catalogue shows the construction and tells the advantages of the Sterling Trap in an interesting and instructive way.

The results obtained by those who use the McKnight Receiver and Oil Separator in connection with their heating systems are reported to be quite remarkable. The saving in water alone in many cases more than paying for the apparatus, to say nothing of the general improvement to the entire system through its use and the benefits of eliminating the oil and grease from the condensation. A circular describing the device in detail will be mailed to anyone writing to Walter J. McKnight, Buffalo, N. Y.

"Vaporite" is an indurated and compressed Asbestos Sheet Packing, made expressly for joints where high pressure or superheated steam is used. It is said that this packing is not injured by temperatures of 1500 degrees, and can be subjected to a compression of 28,000 pounds without losing its efficiency. For circular or samples write A. W. Chesterton & Co., 64 India Street, Boston, Mass.

If you have not yet sent for your working sample of OxoilOx belt dressing write to F. S. Walton Co., 321 Walnut Street, Philadelphia.

"Ten Questions With Their Answers" completes a handsome 20-page pamphlet on the subject of scale grease, and corrosion in steam boilers and how to treat them, by Bird-Archer Co., 90 West Street, New York. Ask for a copy.

Every engineer who is ambitious to make something of himself wants an indicator and not merely an indicator, but a good one, one that he can rely upon. After he gets it he wants to know how to use it to get the best results and most benefit from it. The Improved Robertson-Thompson Indicator, shown on the front page of this issue, is fully and comprehensively described in the catalogue sent out by James L. Robertson & Sons, to intending purchasers. In addition to the description of the indicator, it also contains complete descriptions of the Victor Reducing Motion and Willis Planimeter, and gives a vast deal of instruction useful alike to the experienced operator or the beginner. If you have indicator aspirations write for one to James L. Robertson & Sons, 40 Warren Street, New York.

The Norristown Magnesia and Asbestos Co., of Norristown, Pa., have completed a large new building for the manufacture of air-cell pipe coverings and insulating materials. This company was formerly the Norristown Covering Co. The old corporation, however, has been entirely reorganized. It was found that the old plant, though large, was not large enough to turn out the orders, so a new site was purchased covering some five acres, and the first of the large buildings was opened for operation on August 30. A hundred or more additional hands will be required to operate it. The company manufacture all kinds of asbestos and asbestos-magnesia coverings for steam, water or brine pipes and other insulating purposes. The success of this business has been most phenomenal, having grown in a few years from a very small beginning to large proportions. Yet, Mr. Charles S. Platt, the general manager, declares it is to be larger and still larger, and those who know Mr. Platt know that he makes good.

A Yankee Screw Driver is offered free to engineers upon certain conditions by the Cuncos Manufacturing Co., of Philadelphia. See ad. on page 66 of this issue.

The business heretofore conducted by Mr. J. B. Hackett at 5 and 7 Beekman Street, New York, has been incorporated under the name of the J. B. Hackett Co., and will be continued at the same address with increased capital and larger facilities, all of which will have Mr. Hackett's personal attention.

For those interested in the lubrication of elevator and pump plungers no more interesting example could be found than in the great building of the Merchants' Warehouse Co., at the corner of Chestnut Street and Delaware Avenue, Philadelphia. Here, under the supervision of Mr. Harry J. Rockwood, are sixteen big plunger elevators, supplied with hydraulic power at 140 pounds pressure by three 14 x 11 and 20 x 15 Tandem Compound Pumps. That is, there are three such pumps there ready for service, but only one of them at a time is needed to do the work.

This is because, throughout the entire hydraulic system, friction has been reduced to such an extremely low point that one pump is enabled to accomplish the work which seemingly would require two.

Said Mr. Rockwood: "When taking charge of this plant six years ago I received samples of many greases, and gave them, one after another, a fair trial. Some of them were pretty poor stuff. After a good many more or less troublesome experiences, Keystone Grease No. 3 Density was finally adopted, and has ever since given the best of satisfaction."

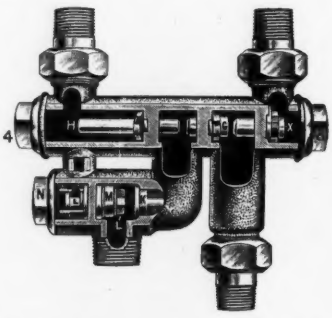
The method of applying is: To place 25 pounds at a time in the packing box of each plunger. This amount lasts about two months, and keeps not only the elevator plungers, but the whole system of pumps, pipes and valves, lubricated and preserved from corrosion. This is because the grease is carried by the exhaust water from the elevator cylinders to every point in the system. No other lubrication of any kind is employed for the water ends of the pumps than that due to the presence in the water of Keystone Grease; and to illustrate the almost entire absence of friction—it has been observed that after the steam is shut off the plungers will make an entire stroke. The cylinders, valves and joints become so permeated with grease that corrosion is impossible, and it is never at all difficult to break joints or remove parts when desired.

As an example of the preserving properties of this circulation of grease in water it is interesting to note that some of the 3½-inch hard rubber valves in the pumps have been in service for six years, and it has not yet been necessary to replace any that were put in new since this grease has been used. The leather caps in the change valve cylinders, which have to meet very severe usage, last from nine months to two years.

HANDLING HOT WATER WITH AN INJECTOR.

While a large majority of boilers carry less than 150 lbs. pressure, the usual high working pressure of the ordinary automatic injector, there is an increased demand for an injector operating between 150 and 200 lbs. pressure. There is also a demand for an injector that will handle a water supply that has become heated by use of the syphon (or ejector) and in other ways and is consequently too hot for injectors of the usual automatic type.

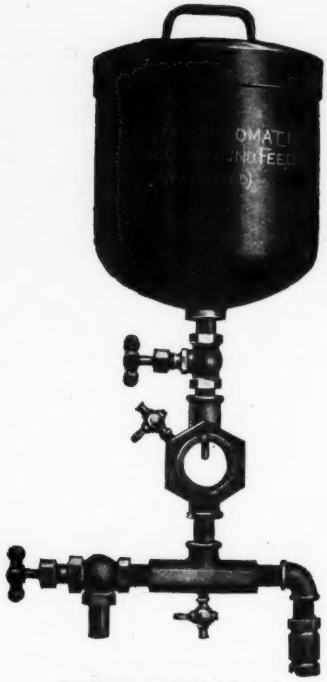
In feeding a boiler with water over 120 degrees Fahr. users of steam experience a great deal of difficulty due largely to their failure to meet the necessary conditions. Consideration must be given to the fact that at a certain point on high steam pressure the condensing qualities of the water are not sufficient. Steam must be condensed before it can pass through the injector. For instance, at 180 lbs. pressure the same volume of feed water will not condense the steam that would be sufficient to condense the steam at 120 lbs. pressure. The higher the temperature of the feed water the less are its condensing qualities and vice versa.



These conditions and requirements have resulted in the production of the Auto-Positive "Penberthy" Injector here illustrated.

This injector *has but five working parts* and combines the features of a positive with those of an automatic injector. By this combination it is enabled to handle much hotter water and work on higher steam pressure.

Space will not permit our handling the subject exhaustively and we would suggest that those interested correspond with the Penberthy Injector Co., of Detroit, Mich., who manufacture this injector. They are always glad to give any information of a technical nature looking to the most productive and economical use of steam as applied with either injectors or ejectors.



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Automatic Pressure Feeder

BOILER COMPOUND FEEDERS

GRAVITY FEEDER

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To feed Boiler Compound in the same old way. Wouldn't it be much easier to use that positive way, that is the RED STAR WAY.

To pay the big price you now pay to keep your boilers free from scale, corrosion, pitting and foaming. The RED STAR WAY is cheaper. If you don't believe it, a postal card for quotations will bring you the reasons.

Free

A Compound Feeder is loaned to each customer.

Analysis made of a gallon of feed water.

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CINCINNATI
907 Mercantile Library Bldg.

NEWARK
15 Fillmore St.

ST. LOUIS, MO.

DAYTON, OHIO

ROCHESTER, N. Y.

KALAMAZOO, MICH.
210 S. Pitcher St.

The C. Lee Cook Manufacturing Co., of Louisville, Ky., have recently issued a booklet describing Cook's Metallic Packing for steam, gas and air. This packing is adapted to power engines of every description, and especially on engines operating under very high steam pressure and superheat. This booklet will be mailed free to anyone requesting it.

You can get the M. E. P. of an indicator diagram without figuring with the Thompson Planimeter, made by Richard Thompson & Co., 126 Liberty Street, New York. A descriptive circular if requested.

The Cassco Plastic Metallic Packing embodies all the features of a soft and a metallic packing. It is made in square or segmental form and can be used on any size rod and on any kind of engine used for steam, ammonia, oil and gas. A copy of a circular describing this packing and its use can be had by addressing the Cassco Bar-Metallic Packing Co., 142 Dearborn St., Chicago, Ill.

The Dillon Exhaust Steam Condenser is a device to separate the oil from exhaust steam, and at the same time to utilize the exhaust for heating feed water, or for heating water for any thing desired, such as wash water, in laundrys, etc. This device is very economical, and meeting with great favor. A circular describing it in full will be furnished by Mason and Ross, Northville, Michigan.

We are in receipt of an attractive catalog just issued by the Standard Steam Specialty Co., 542-544 West Broadway, New York City, illustrating and describing their line of oil separators, feed water heaters, pump governors, steam traps, exhaust heads and other high-grade steam appliances, a copy of which will be mailed to those interested.

A flange union, which can always be made tight and remain so without the use of a gasket, has been recently placed upon the market, known as the "Kewanee" flange union, and is meeting with the approval of discriminating engineers. The Kewanee is fully described and illustrated in a circular issued by The Western Tube Co., Kewanee, Ill.

The perfection shaking and chopping grate has recently been improved by the addition of a larger mesh tooth, with the use of which it is said to burn bituminous coal even better than it did before. This grate seems to have found an easy road to market by pleasing engineers, especially in the east, where many thousands of dollars worth of them have been installed during the past few months. A new illustrated circular, showing the "Perfection" in detail, and explaining its operation, also giving the guarantee of the company, will be mailed free to any one mentioning THE PRACTICAL ENGINEER. Address, Perfection Grate Co., Lyman and Chestnut Streets, Springfield,

A series of mailing cards describing Hine Eliminators, Eureka Sheet Packing, and water columns have recently been sent out by James L. Robertson & Sons, 40 Warren Street, New York. If you are interested ask for them. Or, if you happen to be looking for an Indicator, Reducing Wheel or Planimeter, ask for their Indicator Catalog. It's a good one.

Burrow's Boiler Feed Water Regulator and Low Water Alarm, Burrow's Damper Regulator, Steam Traps, Pump Regulators and other specialties are described in the catalog of the Burrow's Mfg. Co., 73 Warren Street, New York. One of the interesting Burrow's products is their cast bronze float, which is no heavier than the ordinary copper float, but is leakless and practically indestructible.

The Tornado Boiler Flue Cleaner possesses some distinct advantages not found in other types of steam flue cleaners. The principal advantage is that it requires very little steam to operate, and the steam does not enter the boiler tubes, but forces in a current of air which removes all dirt and blows it with great velocity through the longest flues. Those interested in an economical and efficient boiler flue cleaner should write for prices and further particulars to The Paul B. Huyette Co., Inc., 1245 Betz Building, Philadelphia, Pa.

The Kelley mechanical draft system is an efficient and economical method of accelerating your draft where a natural draft is insufficient and the cost is trifling in comparison with the more elaborate systems. A circular describing the system, its operation, etc., can be obtained from Chas. T. Luce, 160 Congress Street, Boston, Mass.

NEW POWER PLANTS AND IMPROVEMENTS

The Chace Mills Co., of Fall River, Mass., wil shortly build a new electric light and power plant.

The Philadelphia Electric Company, of Philadelphia, Pa., have awarded the contract for building an auxiliary power station to John R. Wiggins & Co., of that city. The new building will be a two-story structure of brick and terra cotta, 30 x 60 feet, and will cost $15,000. John T. Windrim, Commonwealth Bldg., is architect and engineer.

The Bristol and Plainsville Tramway Co. are building an addition to their plant in Highland Court, Bristol, Conn. The new building will be two stories high, 42 x 30 feet.

The newly organized Americus Light and Railway Co. is building a new electric power plant at Americus, Ga. It is estimated that upon completion the new power plant will cost nearly $250,000, and will furnish the town with electric light and power to operate an electric railway.

The R. H. Foerderer Co., of Philadelphia, Pa., is building a one-story power house, 50 x 60 feet, at the corner of Garden and Brill Streets.

The Norway and Paris Street Railway Co., of South Paris, Me., are building a new power station, 34 x 40 feet, on the Little Androscoggin River.

The Philadelphia and Reading Railway has awarded the contract for the erection of an electric light, heat and power plant at Rutherford, Pa., to Augustus Wildman, of Harrisburg, Pa. The new power house wil be 56 x 58 feet, built of brick on concrete foundations.

The Raymond Lead Company, of Chicago, Ill., will shortly build an entire new plant on Lexington Street, near Washtenaw Avenue. One of the several buildings will be a power house, 125 x 175 feet.

The Sherman-Dallas Interurban Railway Co. is building a power house at McKinney, Tex.

The Milwaukee Light, Heat and Traction Co. will shortly build a new power house on the west side of Fox River, Waukesha, Wis.

The Springfield Metallic Casket Co., of Springfield, Ohio, is building a new brick power house, 47 x 150 feet.

The Samuel C. Tatum Company, of Cincinnati, Ohio, will shortly build an addition to their plant on Colerain Avenue. The addition will consist of three buildings, each 50 feet square, one of which will be a power house.

The Schaghticoke Electric Company is constructing a large electric power plant on the Hoosick River, Schaghticoke, N. Y.

Engineers Dodge and Day, Drexel Bldg., Philadelphia, Pa., have received permits to build two power houses in that city. One, 29 x 65 feet, for the Walker Electric Co., at Twenty-third and Noble Streets, and one, 23 x 42 feet, for the S. L. Allen Co., Fifth Street and Glenwood Avenue.

The Union Typewriter Co., of Bridgeport, Conn., will build a new power house at their plant in the West End. The building will be one story high, of brick and steel construction, 40 x 80 feet. H. M. Brill, of Chicago, is the engineer.

The Oklahoma City Railway Co. is building a large power plant at Oklahoma City, Okla. The new building will be 102 x 104 feet, of fireproof construction, and will cost $180,000.

The Missouri State Board of Prison Contractors have awarded a contract for equipping the State Penitentiary with a new light, heat and power plant.

SOCIETY NEWS

M. A. Marvan delivered an interesting lecture on "Paralleling Compound Wound Dynamos," before Local No. 1 of the N. A. S. E., at New Orleans, La., on the evening of August 24.

As a result of a recent boiler explosion in Robbins & Spencer's mill, at Nashville, Tenn., a bill will be introduced in councils in that city for the enforcement of the statute for the licensing of engineers. This statute was passed in 1905, and stipulates that any boiler explosion which is due to the negligence of the engineer, shall result in the revocation of the engineer's license, and forbids him to engage in that vocation again.

The engineers' union of Butte, Mont., held its election of officers on September 4, the polls being open all day. This gave members who were employed at night an opportunity to cast their ballots. Kerr Beadle was re-elected to the office of business agent by a unanimous vote.

The N. A. S. E. State Association of West Virginia elected the following officers: President, E. W. Price; vice-president, E. Volts; recording secretary, B. F. Caruthers; financial secretary, R. G. Wilkinson; treasurer, R. J. Alfalter; conductor, G. W. Duncan; doorkeeper, G. F. Mulhern.

N. A. S. E. No. 4, of Bridgeport, Conn., gave their annual shore dinner at Steeplechase Island, on September 4, with about fifty members and guests present.

The Modern Science Club of Brooklyn tendered a reception to the national officers of the National Association of Stationary Engineers, at their club house, 125 S. Elliott Place, on Tuesday evening, September 24.